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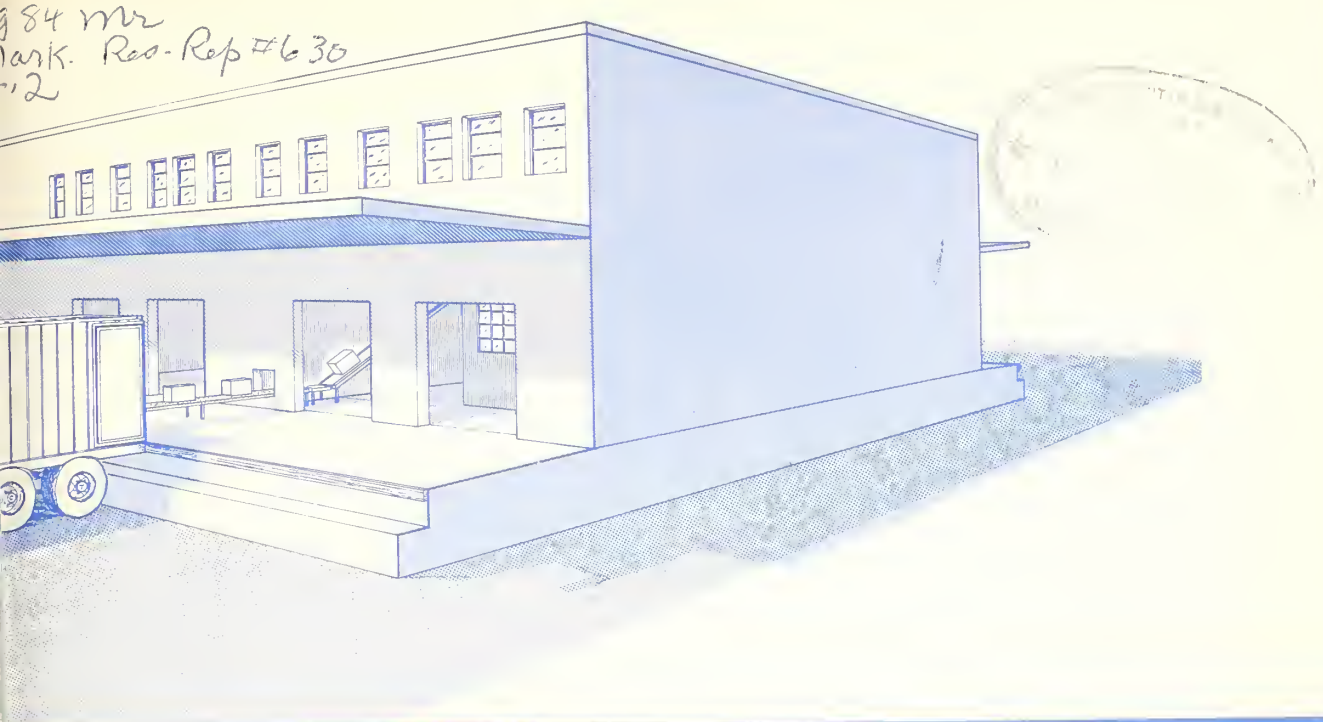

Multiple-Occupancy Warehouses

FOR POULTRY AND EGG WHOLESALERS

• *Improved Designs*

UNITED STATES DEPARTMENT OF AGRICULTURE • AGRICULTURAL MARKETING SERVICE
TRANSPORTATION AND FACILITIES RESEARCH DIVISION • MARKETING RESEARCH REPORT NO. 630

Preface

A study was conducted in the warehouses of typical independent poultry and egg wholesale distributors in New York, Chicago, Philadelphia, and Washington, D.C., by the Handling and Facilities Research Branch of the Transportation and Facilities Research Division, Agricultural Marketing Service, U.S. Department of Agriculture.

The report is based on studies of facilities under actual operating conditions, to determine the feasibility of modernizing outdated plant structures. Modern specialized service needs were considered, and remodeling was judged to be infeasible. New structures and layouts that would provide facilities capable of operating with efficiency, flexibility, and good sanitation are described in the report.

The structure and layout recommendations provide guidelines for facilities similar in dimensions to those in multiple-occupancy warehouses located in modern food-distribution centers. They also provide flexibility that permits a choice of service operations in a single layout at commodity volume levels and combinations prevalent in today's wholesale poultry and egg business.

Thomas F. Todd, now with the Market Facilities Planning Staff of the Division, gathered much of the data on existing warehouse conditions and service operations. The managements of the poultry and egg wholesale firms studied made many suggestions and wholeheartedly cooperated in the study.

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Summary

Plans are given in this report for a dual-use poultry or egg wholesale warehouse in a multiple-occupancy building in a food-distribution center. If the wholesaler dealt primarily in poultry, he could handle 135,300 pounds of icepacked and frozen poultry, print butter (or margarine), and processed cheese, and 600 cases of shell eggs weekly. If eggs are his primary product, he could handle 1,800 cases of eggs and 28,700 pounds of egg meat, print butter, and processed cheese a week.

As a basis for the recommendations in this report, the warehouses and operations of 13 typical poultry and egg wholesalers in 4 large cities were studied. The influence of warehouse design, type of construction, condition of the buildings, and site location on operating efficiency was determined.

Most of the plants were in old buildings in the hearts of the cities; many of these areas were being considered for redevelopment. Because of traffic congestion, outdated construction, high land cost, and the type of wholesale service offered, modernizing the warehouses was not considered feasible. The most economical and efficient plan was for the poultry and egg wholesalers to relocate in a multiple-occupancy building in a food-distribution center outside the high-cost downtown areas.

The case study showed that, while a large variety of products and services were offered, wholesalers were primarily either poultry or egg distributors. The basic plan recommended in the report could be used efficiently by either category.

Guidelines for plant builders and operators include: Plant layouts, crew sizes for efficient operations, and refrigeration and heating needs.

MULTIPLE-OCCUPANCY WAREHOUSES FOR POULTRY AND EGG WHOLESALERS

• Improved Designs •

By John A. Hamann and W. Roy Forbus
Transportation and Facilities Research Division, Agricultural Marketing Service

Background

During the past few decades the production, marketing, and transportation patterns for the Nation's poultry and egg crop have changed remarkably. The revolutionary nature of this change and the implications to the wholesale poultry and egg distributor are reflected by marketing statistics. U.S. Department of Agriculture reports for 1930 did not include commercial broiler production because of its insignificance at that time, whereas in 1960 more than 1.75 billion commercial broilers were marketed.[1] A majority of these moved through large-volume, highly mechanized chicken (mostly broiler class) processing plants, frequently bypassing the wholesale distributor located in the old city market districts with direct deliveries to large retail outlets.

In 1930, over 225 million pounds of live poultry arrived in New York City, 200 million by rail.[2] In 1959 only 58.5 million pounds of live poultry were received in that city, none of which was shipped by rail.[3] Reports on live receipts at six markets were discontinued after 1960. In 1931 over 9.5 million cases of eggs were reported in cold storage.[4] In 1960 this figure had, after a steady decline each year, dropped to approximately 2 million cases.[1] At the beginning of the Second World War, only a small percentage of the country's poultry (mostly turkeys) was prepared as ready-to-cook; the remainder was prepared as New York dressed (blood and feathers removed). Today it is estimated that more than 90 percent of the poultry marketed is sold in ready-to-cook form. Whereas these changes in production and marketing were accompanied by many changes in services performed by poultry and egg wholesale distributors, few changes were made in warehouse facilities.

Since January 1, 1959, the effective date of the Poultry Products Inspection Act, all poultry moving in interstate or foreign commerce must be inspected by the U.S. Department of Agriculture.[5] This legislation had a profound effect on the nature of the services that wholesale distributors of poultry could offer. Where distribution of live poultry and processing dressed poultry had given way to dressing and eviscerating, facilities, equipment, and methods for these operations now required compliance with Federal regulations. Generally this involved major building alterations and installation of new equipment. The problems and expense of plant conversion to meet these requirements and the economic advantages of large-volume processing operations at country points rapidly discouraged poultry processing operations in large cities by wholesale distributors. Some advantages of rural processing included: (1) Shipping live poultry short distances from production point to processing plant reduced hauling costs and live-weight shrinkage to a negligible level; (2) less in-transit dehydration of the live bird permitted a faster, better processing job; (3) rapid refrigerated transportation permitted daily shipments of freshly processed poultry to major markets; (4) the close relationship that developed between country processor and producer (geographically and financially) resulted in an easily controlled balance of supply of live poultry and processing capacity; (5) labor near the country processing plant was available and cheap; and (6) country plants could ship direct to large retail stores.

The marketing pattern for the national egg crop experienced a similar change. Formerly eggs were picked up at the farm by hucksters' trucks or assembly plant route trucks, or delivered direct by producers to assembly plants. These plants assembled large and small lots of all size classes and qualities for shipment to distant markets, for storage or grading, or both, packing into consumer containers, and delivery to retailers. The spring egg surplus was stored in large commercial cold-storage warehouses located in the produce market

[1] U.S. Department of Agriculture. Agricultural Statistics, 1961. 624 pp. Washington, D.C. 1962.
[2] U.S. Department of Agriculture. Agricultural Statistics, 1945. 604 pp. Washington, D.C. 1946.
[3] U.S. Department of Agriculture. Agricultural Statistics, 1960. 633 pp. Washington, D.C. 1961.
[4] U.S. Department of Agriculture. Agricultural Statistics, 1941. 731 pp. Washington, D.C. 1942.

[5] Public Law 85–172 and AMS–219, Information for Applicants for Poultry Inspection, 12 pp. Jan. 1958.

section of large cities. Usually, they were convenient to poultry and egg wholesale distributors' warehouses and, in many instances, provided warehouse space for them. In Chicago and New York, refrigeration was piped from the cold-storage warehouse to wholesalers' premises in some of the produce sections at a nominal charge. Poultry breeding and production practices have flattened out the egg production curve, so that the need for long-term storage of shell eggs is not now a significant factor in egg marketing. This, coupled with refrigerated rapid-transit trucking and improved grading and packing equipment, has made it possible to grade and pack consumer grades at country plants that have gained benefits similar to those experienced by poultry plants. Now these plants can also deliver direct to retail stores in urban areas.

As the marketing patterns have changed, the function and facility requirements of the wholesale distributor of poultry and eggs have also changed. Wholesalers now offer specialty services such as supplying small lots of cut-to-order poultry, shell eggs packed to order, egg meat supplies, and the like, to such customers as steamship lines, city institutions, hotels, restaurants, small retail markets, bakeries, and similar outlets requiring special facilities and frequent small deliveries that are difficult or costly to deliver in large trucks.

Some specialty services included such items as:

Fresh split broilers or specific chicken parts prepared and packed for restaurants and hotels;

Fresh or frozen chicken or turkey parts for small retailers, prepared as ready-to-cook in country plants;

Fresh broken whole egg or special egg meat mixes for bakeries;

Egg breaking and canning of small lots of eggs (below table grade) for wholesalers not equipped with breaking facilities;

Grading and packing shell eggs for small retailers, hotels and restaurants, and the like; and

Stocking small inventories of such items as butter (or margarine) and cheese.

Wholesale Services and Facilities Observed in the Study

The warehouse facilities of a representative group of wholesale distributors located in the old market districts of New York, Chicago, Philadelphia, and Washington, D.C., were studied. The buildings were from 25 to 75 years old and usually located in or near the produce section of the city. Building design and construction were quite similar; the layout and operating efficiency were frequently affected adversely by the type of construction.

Types of Services Rendered

Originally, wholesale distributors received wholesale lots of poultry and eggs (and often dairy products as well) and distributed them to jobbing wholesalers or retailers. The limited nature of this service required only a shell structure, devoid of any facilities except heat, light, and water, located near or in a commercial refrigerated cold-storage building, and served by three or four people. As the marketing methods and locations of processing, grading, and packing operations changed, a variety of services were added to attract customers.

Of the 13 case-study plants, 6 (A through F—table 1) were handling icepacked eviscerated poultry and each operated a cutup and parts packing service. Three plants (J, E, and I) operated an egg grading and packing service for special accounts as a major part of their business, while four others (A, F, K, and L) provided the service as a minor activity. Three firms operated modern egg breaking plants as major activities and one plant deboned and smoked turkeys. Ten offered minor services such as distributing natural or processed cheese, butter, margarine, rendered chicken fat, sour cream, lard, and the like, all in small quantities. Not one of these plants distributed only one item such as poultry or eggs. In one instance an "oldtime" wholesale distributor of poultry, eggs, and frozen egg meat (plant H) had added a few specialty items such as high-priced red meat cuts, and furnished rapid delivery service on his main stock items to any point in the city, mainly to outlets such as hospitals, hotels, restaurants, and catering service companies requiring frequent small deliveries.

Plant Site

All but one of the case-study plants were located in the produce market section of the city, through which a heavy stream of truck and car traffic flowed on narrow streets from early morning until midafternoon (fig. 1). The traffic frequently delayed the arrival and departure of shipments and limited customers' access to the plant.

The buildings generally fronted on narrow streets. Some abutted on narrow alleyways in the rear. The building sidewalls either touched or were part of the adjoining buildings on either side. Most truck loading or unloading encroached on the sidewalks (fig. 2), or the sidewalks, raised or at street level, served as loading platforms (fig. 3).

In one city, an ordinance prohibited the loading of trucks in the downtown area if truck length exceeded 33 feet. Large trucks had to be unloaded at a steamship pier on the nearby waterfront (set aside for this purpose by the city) at a cost of $0.03 per case of eggs for the use of the facilities and $0.12 per case for trucking them to the plant in small lots.

TABLE 1.—*Commodities handled and services rendered by wholesale poultry and egg distributor case-study plants* [1]

Type of service	Weekly volume	Plant												
		A	B	C	D	E	F	G	H	I	J	K	L	M
Packing shell eggs [2]	175–600 cases	X				X			X	X	X	X		
Grading and packing shell eggs.[3]	601–2,000 cases	X				X	X			X	X	X	X	
Egg breaking, canning, and freezing.[4]	4,500–20,500 lbs									X	X		X	X
Icepacked poultry [5]	1,400–144,000 lbs	X	X	X	X	X	X							
Frozen poultry [6]	2,000–50,000 lbs	X	X	X	X	X	X		X				X	
Poultry parts, cutup or deboned poultry.[7]	4,000–25,000 lbs	X	X	X	X	X	X	X						
Specialty items [8]	2,000–11,000 lbs	X		X		X	X	X	X	X	X	X		X

[1] Jobbing volume of product not entering plant excluded. Unlike typical job lots, these transactions are generally in truck lots and involve other wholesalers.

[2] Graded or packed on premises.

[3] Grading and packing on premises; mainly carton pack.

[4] Egg breaking and canning on premises; may involve both frozen or liquid, formula mixes, or plain egg meats. Freezing and storage of egg meats on premises or by commercial cold-storage firm.

[5] Ready-to-cook icepacked poultry processed and packed by another firm.

[6] Ready-to-cook frozen poultry processed and packed by another firm.

[7] Ready-to-cook poultry processed by another firm; cutting up, deboning, and repacking on premises.

[8] Making up and distributing small lots of natural or processed cheese, butter, margarine, and other commodities.

Space for plant expansion was seldom available and then generally limited to the acquisition of an adjoining building. In three cities, some plants were located in produce market sections in proposed redevelopment areas, causing doubt as to the feasibility of extensive modernization. The owners or operators of these plants were either preparing to relocate or were in a quandary as to the most desirable site, structure, and plant layout to use when the time came for them to move.

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FIGURE 1.—Traffic congestion typical of wholesale produce district.

Building Design

Most of the plants were in multistory structures, with masonry load-bearing walls. Some occupied space leased from cold-storage companies operating multistory refrigerated warehouses. Floor dimensions ranged from 19 by 120 feet to 60 by 167 feet. The majority had a one-to-three or one-to-four width-to-depth ratio.

Ceiling heights ranged from 6½ to 8½ feet in basements and 10 to 14 feet above ground level. Clear spans seldom exceeded 25 feet, and supporting columns were generally of wood. Floors were connected by both stairways and elevators. Elevators were slow; they had a 5,000-pound capacity, but elevator shafts and door widths frequently limited loads to one 3- by 4-foot pallet. Temporary partitions separated work, storage, and office areas, and varied greatly among plants. Ceilings

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FIGURE 2.—City sidewalks serve as loading platform.

were generally enclosed with battened plywood or extruded sheet metal in processing and office areas. Roofs were flat with a slight pitch to the rear, and were of tar- and gravel-coated wood decking. Because the sidewalls of adjoining buildings were generally a part of or touching the sidewalls of the plant's building walls, window and door openings were confined to the front and rear. Windows were either wood frame and sash, weighted, or metal frame, project-out type. Doors were overhead rollback or single-action double or single doors. Old passageways connecting adjoining buildings had been permanently closed because of city fire regulations.

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FIGURE 3.—Narrow loading platforms encroach on city sidewalks.

Facilities and Equipment

The buildings that housed the plants initially furnished only the most meager facilities: Light, water, toilets, and, in some instances, heat. A number of plants had installed elevators or belt conveyors, or both, and makeshift docks.

REFRIGERATION FACILITIES.—Most plants that had refrigeration were either in a commercial cold-storage warehouse or had refrigeration piped in from a nearby cold-storage plant, paid for at a monthly rate. All refrigeration was furnished by ceiling- or wall-suspended coils (figs. 4a and 4b). Low ceilings or ceiling-suspended coils frequently eliminated the possibility of high stacking.

In warehouses where only open loft space was furnished, the management had installed portable walk-in refrigerators (fig. 5) that furnished satisfactory refrigeration but, because of limited space, overcrowding frequently caused handling inefficiencies, container and product damage, and difficulties in inventory control (fig. 6).

Most refrigeration space used for the handling of icepacked poultry was not equipped with floor drains. Melting ice made it a disagreeable and hazardous place to work (fig. 7).

DRY STORAGE FACILITIES.—Dry storage space was normally confined to unpartitioned loft space or upper floors, basements, and the areas on either side of the entrance aisle on the first floor. The principal problems arising from these locations were the slow elevator service to floors above or below street level, narrow access aisles to elevators, column interference, and low ceilings in basements (figs. 8a and 8b). These features reduced the advantages of unit load handling and, in many instances, hand stacking was required to use the space.

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FIGURE 4*a*.—Ceiling-suspended refrigeration coils frequently canceled the advantages of high ceilings.

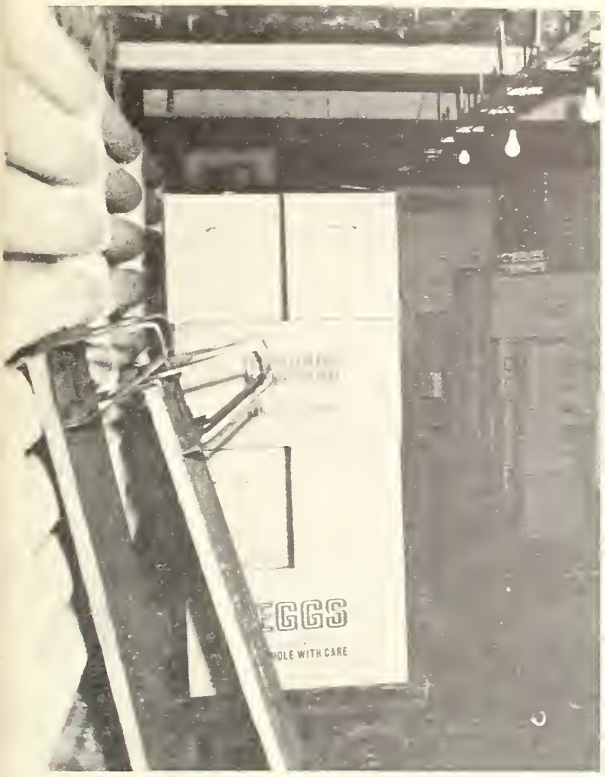

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FIGURE 4*b*.—Wall-suspended coils used in rooms with low ceilings.

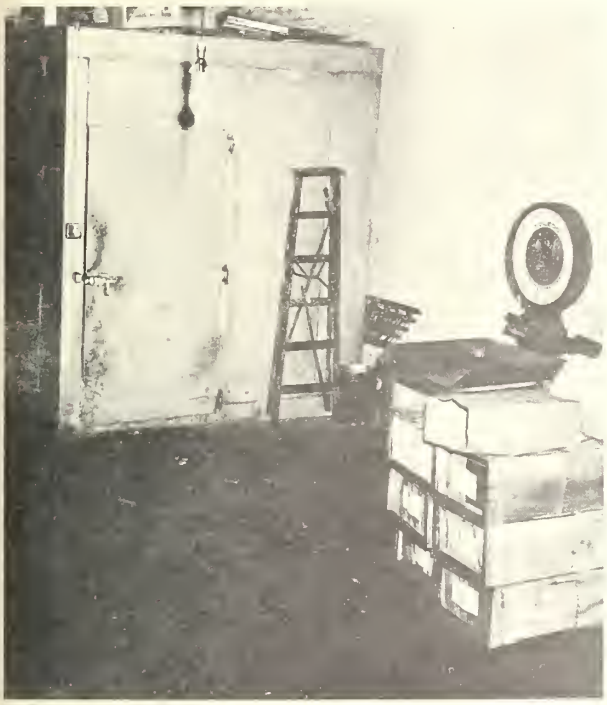

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FIGURE 5.—A portable walk-in refrigerator installed on the first floor of a wholesale distributor's warehouse.

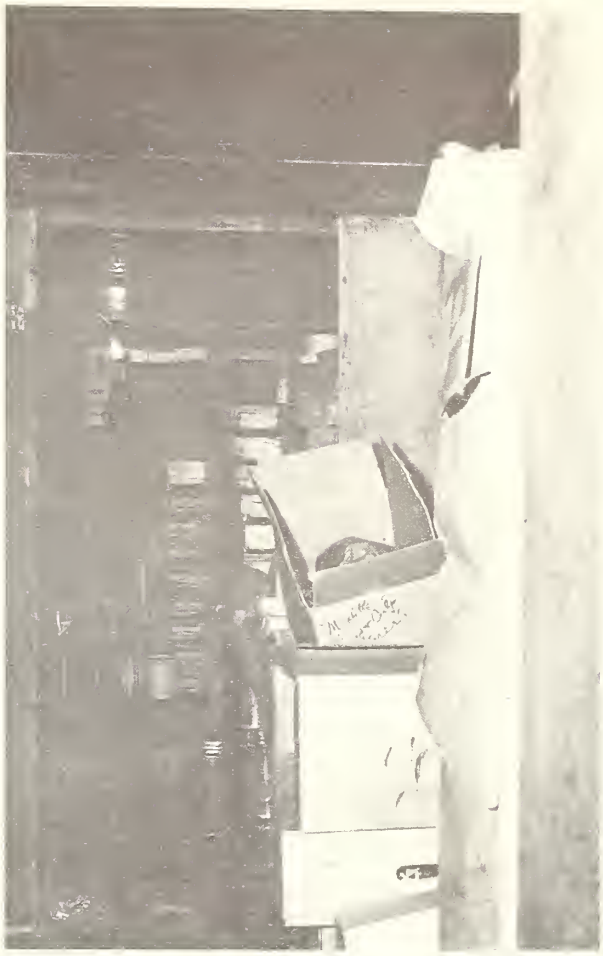

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FIGURE 6.—Limited refrigeration space results in narrow aisles, tipped stacks, broken containers, product mistreatment, rehandling, and a cluttered appearance.

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FIGURE 7.—Standing water drained from icepacked poultry was a nuisance common to coolers, work areas, and worker passageways.

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FIGURE 8*a*.—Low, narrow storage space in basements was frequently congested.

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FIGURE 8*b*.—Loft storage space was difficult to fully utilize because of column interference.

WORK AREAS.—Work areas were separated into two broad categories: Processing and order assembly. Order assembly operations occasionally encroached on the processing areas.

In cases where the processing involved cutting, weighing, or repacking poultry, operating efficiency was greatly reduced because of crowded and cluttered work space (figs. 9 and 10).

Absence of floor drains and badly worn floor surfaces created a nuisance and hazard to workers cutting up or repacking icepacked poultry. In most plants the condition and construction of the buildings did not warrant the expense of resurfacing or installing new processing area floors or drains.

In one facility, the production and canning of egg meats was done in rooms that had been remodeled at considerable expense (fig. 11). Ceilings and walls were surfaced with water-impervious materials. Floors of smooth cement or tile were properly pitched to trapped drains to provide runoff of processing water. Utensil cleaning space in these areas was well ventilated and equipped with multicompartment sinks and drain racks.

In some plants that were studied, order assembly areas were congested when receiving and shipping time coincided, causing confusion and inefficient operations. During these periods, the shipping operation was moved to any convenient area available (figs. 12a, 12b, and 12c), such as the sidewalk in front of the plant, or the processing room. Narrow aisles in shipping and processing areas also reduced efficiency.

PROCESSING EQUIPMENT.—Equipment ranged from plain metal-topped tables, knives, and cutting boards for cutting up poultry to elaborate mechanized egg breaking and separating equipment (figs. 13a and 13b). Most plants used polished stainless-steel equipment where contact with food was involved.

Some distributors went to considerable expense for modern, mechanized equipment and plant renovation to perform specialty services in marketing shell eggs and poultry (figs. 14a and 14b). However, even after these improvements, the layout of the plant with the remote location of supplies, personal facilities, management offices, and frequent rehandling sharply reduced the economies that could normally be expected.

MATERIALS-HANDLING EQUIPMENT.—In all but one plant, manual unit-load handling equipment was used. Most plants employed the two-wheel stevedore-type handtruck or the four-wheel flat truck. Four plants used handtrucks and semilive skids and jacks, or dead skids and manual hydraulic low-lift platform trucks. One plant used pallets and a rider-type electric forklift truck, together with some manual equipment. Five plants used portable gravity roller conveyors or belt conveyors, or both, for truck loading and unloading (figs. 15a, 15b, 15c, 15d, and 16a and 16b).

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FIGURE 9.—Insufficient work station space reduced crew productivity.

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FIGURE 10.—Congested processing areas were frequently cluttered and difficult to keep clean.

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FIGURE 11.—Egg-breaking room after a regular cleanup.

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FIGURE 12*a*.—These orders were made up on the public sidewalk and await loading into nearby trucks.

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FIGURE 12*b*.—Orders made up in processing room contribute to congestion in an already crowded area.

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FIGURE 12*c*.—A narrow aisle reduces freedom of movement through this plant.

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FIGURE 13*a*.—Stainless-steel table for cutting up poultry (the wood cutting board is unacceptable).

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FIGURE 13*b*.—Mechanized egg-separating (yolks from whites) equipment.

BN–36944

FIGURE 14*a*.—The advantages of increased production of this mechanized egg grading and packing line are largely offset by rehandling required in crowded area.

BN–18733

FIGURE 14*b*.—Poultry was supplied to the modern processing line in this plant from another building (see conveyor, upper left). After processing, the poultry was conveyed to still another building for freezing. Circuitous routing of product offset the economy of modern assembly-line methods.

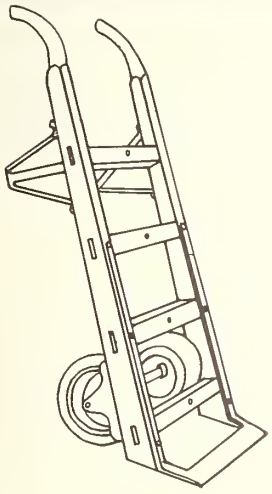

FIGURE 15*a*.—Two-wheel stevedore-type handtruck.

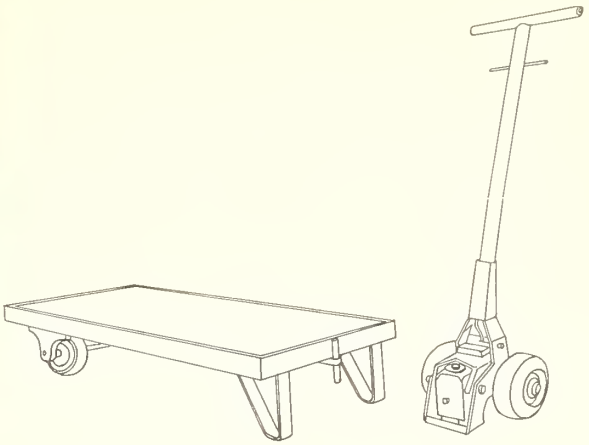

FIGURE 15*b*.—Jack and semilive skid.

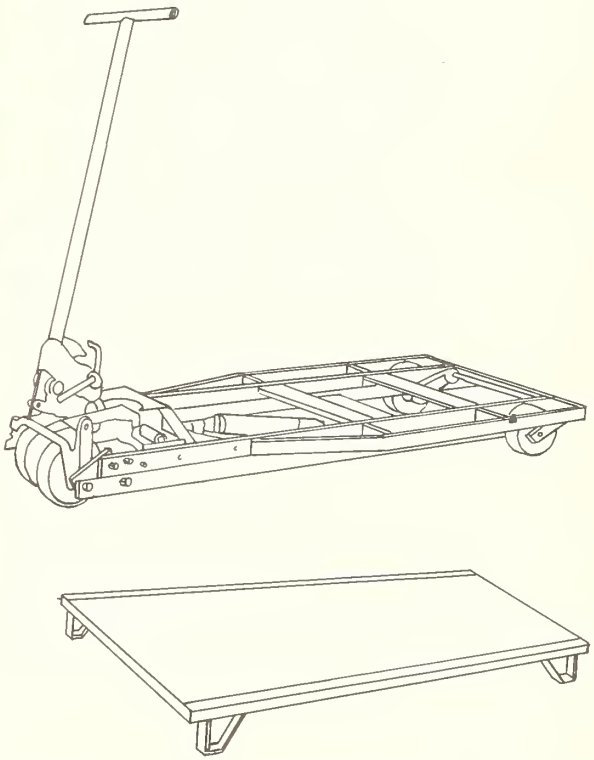

FIGURE 15*c*.—Hydraulic low-lift platform truck and dead skid.

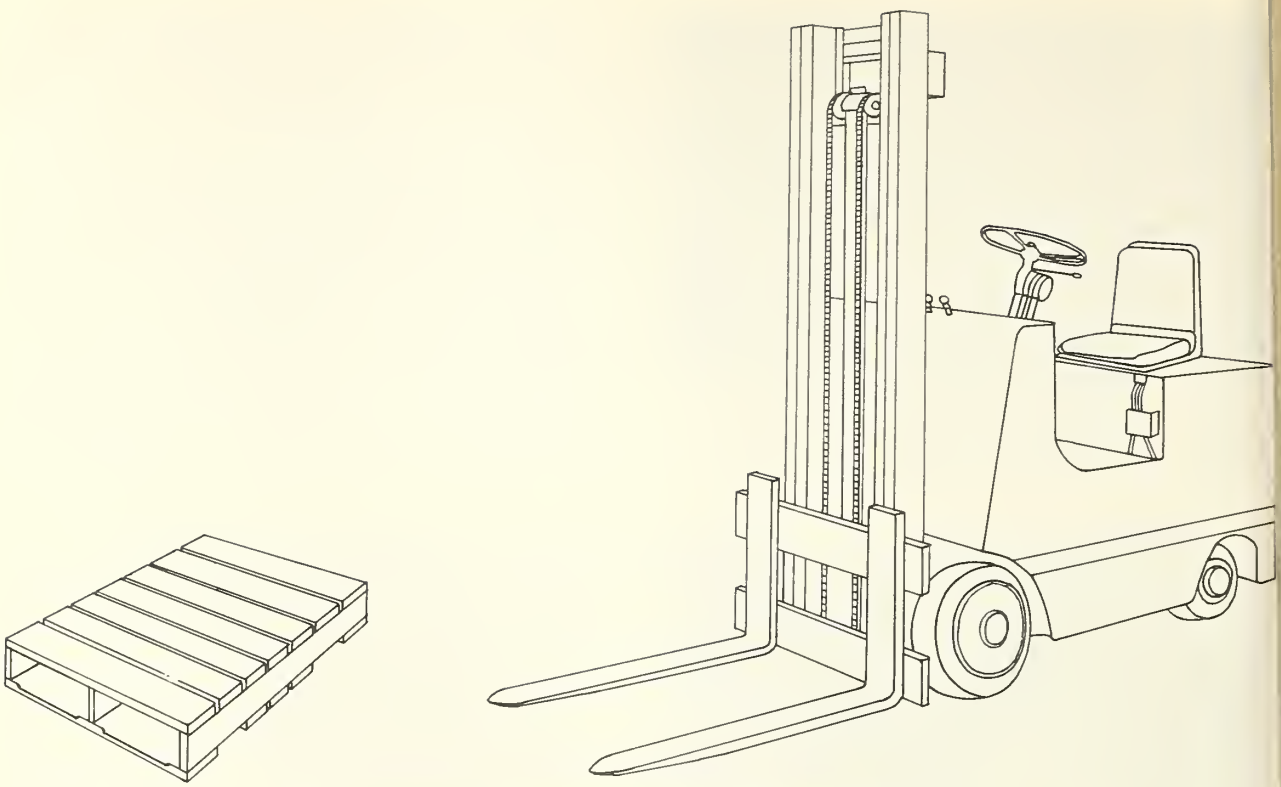

FIGURE 15*d*.—Pallet and rider-type forklift truck.

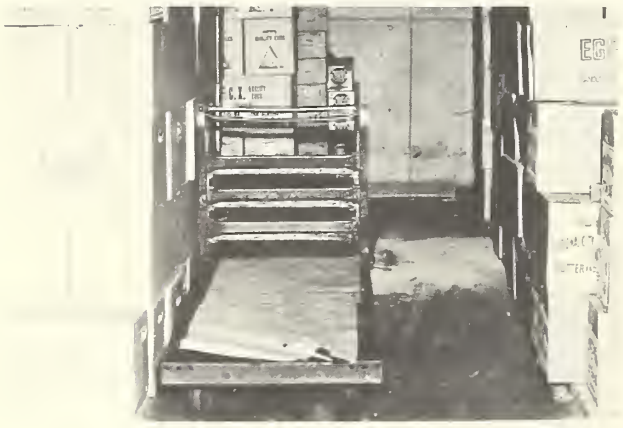

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FIGURE 16*a*.—Four-wheel flat truck.

BN–18747

FIGURE 16*b*.—Loading a truck with belt and gravity roller conveyor.

The main reasons for using the two- or four-wheel handtruck were the small size of orders (and frequently mixed sizes of containers), narrow aisles, and the rough floors that endangered large unit loads.

REFUSE ROOM.—Although all plants accumulated considerable refuse during a normal day's operation, only one plant had a room specifically designed for collecting refuse (fig. 17*a*). Two were equipped with incinerators. The remaining plants used garbage cans, most of which were old oil drums with the tops cut out (fig. 17*b*).

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FIGURE 17*a*.—A refuse room that can hold two skid loads of waste containers.

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FIGURE 17*b*.—Refuse in open containers creates a nuisance and attracts insects and rodents.

BN–18732

FIGURE 18.—An employees' lunchroom that provides space for all workers.

PERSONNEL FACILITIES.—All plants were equipped with toilet facilities, but few of them met the needs of adequate employee restrooms or dressing rooms. Three plants had an employees' lunchroom, only one of which (fig. 18) was considered adequate.

As a general rule, toilet rooms were small, poorly ventilated, and frequently were located on another floor or at the opposite end of the building from the area where a majority of the plant workers were stationed. Locker or dressing rooms were either nonexistent or small and poorly located. Personnel facilities in all 13 plants required enlargement or relocation closer to processing areas. Most needed renovation and ventilation.[6]

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FIGURE 19*a*.—Typical shipping office.

BN–18739

FIGURE 19*b*.—Typical general office.

[6] Hamann, John A., and Todd, Thomas F. Improved Designs for Commercial Egg Grading and Packing Plants. U.S. Dept. Agr. Mktg. Res. Rept. No. 422, 45 pp., illus. Jan. 1961.

Offices.—Office space—divided into two categories: Shipping and receiving (fig. 19*a*) and general (fig. 19*b*)—was usually separated from the rest of the plant by wood and glass partitioning. The shipping and receiving office, located near the order assembly area on the ground floor, was a cubicle large enough for a telephone, writing shelf, and one worker. The general office was located either on the second floor or at the rear of the first floor, and provided ample space for the owner or manager, sales force, and bookkeepers.

Machinery and Shop Space.—Only 1 plant in 13 had a machinery and shop room. This was probably because some plants were leased and refrigeration, elevators, heating, and lighting were furnished. Because these services were furnished, and only manual materials-handling equipment and a small amount of complex processing equipment was used, little consideration was given to a plant shop and machine room. The plants that supplied their own refrigeration and operated some mechanized equipment had not provided for adequate maintenance service. Compressors were frequently located in aisles and were usually unshielded (fig. 20), creating a hazard to workers and handling equipment. Compressors were also in crowded quarters (fig. 21) that handicapped regular servicing and maintenance.

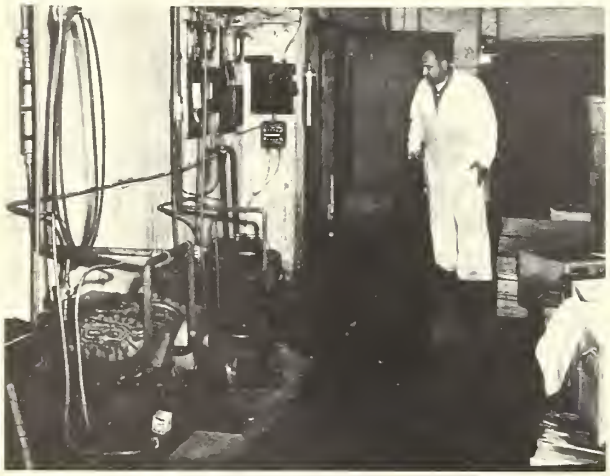

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Figure 20.—Unshielded refrigeration equipment in aisle endangered both equipment and workers.

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Figure 21.—A dingy, crowded, and poorly ventilated machine room discouraged good maintenance.

Typical Problems Encountered in Case-Study Warehouses

Plant Site

1. Buildings fronted on narrow streets that were heavily congested with truck and auto traffic during receiving and shipping times.
2. Access to the rear of the warehouse was nonexistent or limited to a narrow alley that was inaccessible to most delivery trucks.
3. Absence of or narrow loading docks frequently required that sidewalks be used for order assembly, shipping, and receiving.
4. Building width frequently equaled the width of the site, and the warehouse usually touched adjoining buildings so that extension of building width was impossible and addition of anothe another building unit difficult.
5. The produce market section was frequently located in or near a redevelopment area; the wisdom of investing in major building modification in such an area is questionable.

Building and Facilities

1. The type of building construction and column spacing made efficient plant layouts impossible.
2. Building type, age, and construction made structural alterations difficult and costly.
3. Water-permeable floors at street level and above limited water-discharging processing operations to basement levels.
4. The absence of floor drains for waste water runoff from poultry cut-up or egg-breaking operations created a hazard to worker safety and a nuisance in plant sanitation.
5. Low ceilings and poor ventilation and drainage made processing operations at basement level unsatisfactory.
6. Installation of floor drains in old concrete floors was impractical and costly.
7. Replacement of wooden floors and joists with concrete and steel was too costly and would

probably require extended plant shutdown for alteration.
8. Remote location or lack of toilets required additional toilet facilities and installation of auxiliary sewerage lines.
9. Personnel facilities required renovation and enlarging.
10. Lack of space for order assembly required the use of sidewalks or encroachment on crowded processing areas.
11. Inadequacy or absence of loading docks required costly rehandling.
12. Slow elevators increased handling time.
13. Rough floors and narrow aisles slowed movement of products and limited materials-handling equipment to two- or four-wheel handtrucks.

Improved Warehouse Designs and Layouts

Modernization of existing poultry and egg wholesale distributors' warehouses was not considered feasible because of building construction, age, location, degree of modification required, and, frequently, the owners' concern over excessive tax increases. The designs of improved layouts for new structures were developed after careful consideration of the combinations of services being rendered, the volume and variety of products handled, sanitary requirements, and adaptability to space and dimensions generally encountered in multiple-occupancy buildings of modern design.

An analysis of typical operations showed that services (table 1) were divided into two broad categories: (1) Operations handling a large volume of icepacked poultry and cutting up or packing some of it to specialty requirements as a principal service, and handling a small volume of graded eggs, butter, cheese, margarine, frozen poultry, and the like, as a secondary service; and (2) operations involving the grading or packing, or both, of a large volume of graded or ungraded eggs, or both, and breaking, mixing, canning, and freezing eggs as a principal service, with the distribution of some sideline items, such as butter, cheese, margarine, frozen poultry, and the like, as a secondary service.

An analysis of the flow process charts (appendix figs. 34 and 35, pp. 35 and 36) for each type of operation shows that the general flow of products and materials and the facility requirements are similar. Basic requirements involve facilities for a food-processing area that can handle a "wet" operation (runoff water from the poultry cut-up or egg-breaking operations), a "dry" warehouse area for egg grading or packing, or both, and storage of packing materials, a refrigerated storage area, and the service areas (order makeup, receiving and shipping, machinery, offices, employee facilities, and refuse room).

The cross-charts [7] (appendix tables 3 and 4, p. 37) for both operations at specified volumes show that the greatest number of product and material movements occur between the same areas of the plant. The cross-charts also show the most desirable location of each area in relation to other areas. The areas between which the greatest number of movements occur were placed as close to each other as possible, so that transport distances and labor could be held to a minimum. Movement between the various areas showed that their relative locations should be about the same for both types of operation.

Due to the similarity of facility requirements, operations, and desired location of areas within the plant, it was possible to design and lay out a multipurpose facility that could accommodate poultry and egg operations within the prevailing volume ranges and combinations of services being rendered.

To develop efficient layouts that would fit the needs of wholesale distributors with different volumes and combinations of service, the plant layout was designed around the food-processing room and cold-storage facilities. Flexibility was another important consideration. Through analysis of operations and projection of the findings with templates and layout board, the location and space requirements for the work and storage areas were developed. Space needs and location of auxiliary areas were then determined. Layouts were developed for both categories of operations in a single unit of a multiple-occupancy structure. Product volumes handled in the case-study plants were used as guidelines.

Multiple-Occupancy Warehouses

The design and dimensions of the improved layouts are similar to those existing in many wholesale food-distribution centers in the United States. Each unit is 30 feet wide, 70 feet deep, 23 feet high from floor to roof, with covered front and rear docks, each 14 feet deep with 18-foot canopies (fig. 22). The major structural difference between most existing multiple-occupancy warehouses and the one proposed in this study is the recommendation for a second floor (10 feet from floor to ceiling) instead of only an office mezzanine. The first floor is 12 feet high.

The floorspace required for a typical wholesale poultry and egg operation exceeds that available on the one floor and mezzanine of a standard multiple-occupancy warehouse unit. The additional space had to be obtained by expanding the layout horizontally in another unit of similar construction or expanding vertically by extending the

[7] Cross-chart—A chart showing the number of unit loads of product and material moved from one area in a plant to another area within a specified period of time.

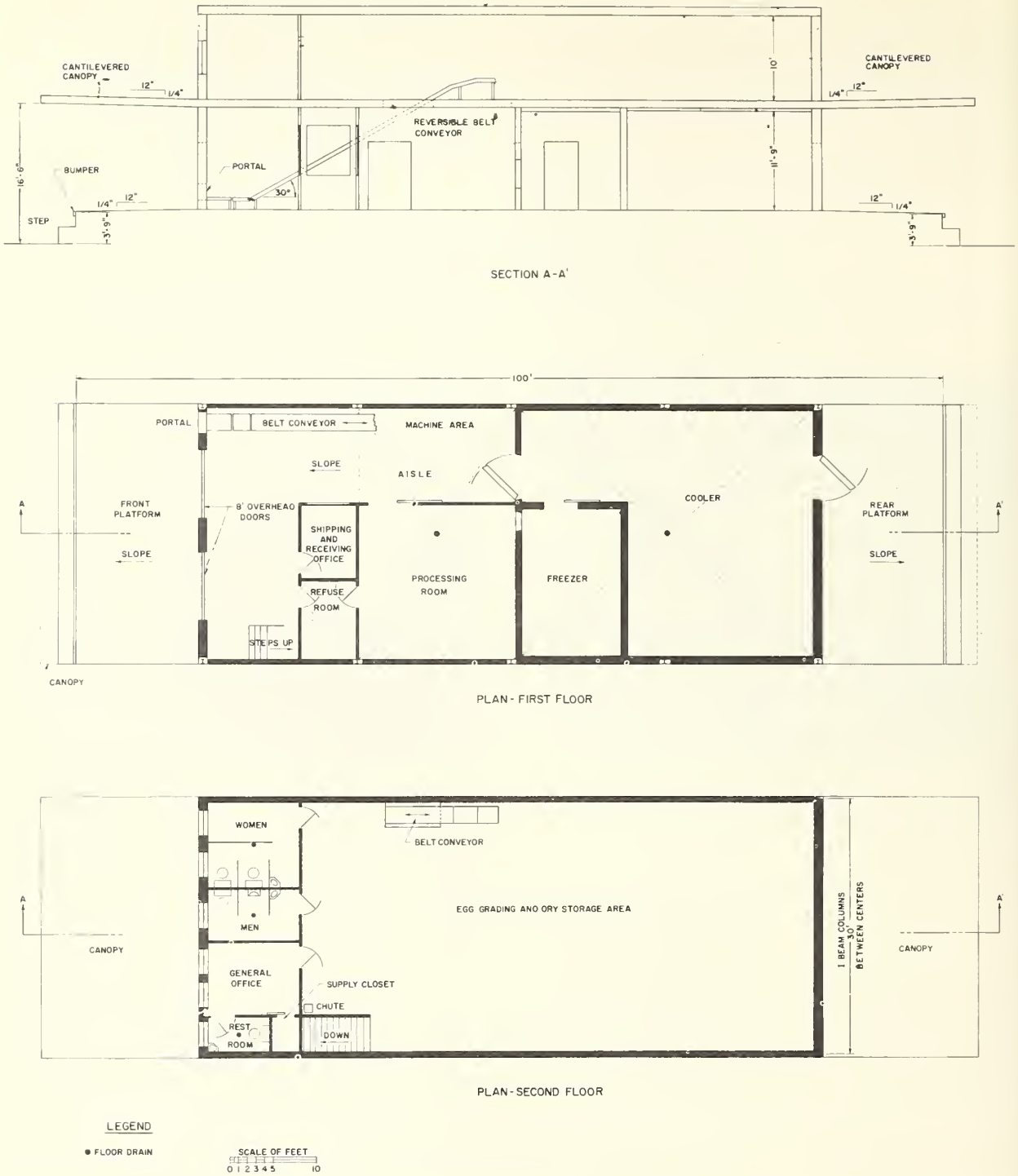

FIGURE 22.—Improved design and layout of a multiple-occupancy warehouse unit for a wholesale poultry and egg distributor operation.

mezzanine to form a complete second floor. The additional cubic space required could be obtained on a second floor within the general overall dimensions of a typical unit. If the layout had been expanded into a duplicate unit, the total cubic space available would have been excessive and could not have been used efficiently. Further, costly construction features (drainage lines, floor-load capacities greater than needed, and higher than necessary ceiling clearance) for the additional unit were not required. Shell eggs in fiber cases should not be stacked more than 9 cases high, or 10.5 feet, and icepacked poultry in wirebound boxes 6 boxes high, or approximately 5 feet, because of container and handling characteristics. So the 12-foot-high first floor in the layout is adequate. Vertical expansion into a two-story structure was therefore considered practical and economical. In addition to these advantages, conversion of a high-ceiling single-story unit into a two-story structure permits full utilization of the space above a large refrigerated storage area.

Other factors that favored the multistory unit were lower construction costs, compactness, and a sizable decrease in land requirements. These advantages far offset the relatively small increase in handling costs when low-activity operations are located on the second floor. These factors are all significant when considering a food-distribution center with a number of these units.

The development of layouts for this type of warehouse was different from the usual layout problem: The aim was a layout that would accommodate poultry and egg wholesalers who provide a variety of services, with varying ranges of product volume in building units of the same dimensions.

The building construction and dimensions of an average unit dictated the location of certain areas within the plant. The refrigerated storage areas and "wet" processing room were located on the first floor because of the great number of products normally moving between these areas, and the heavy floorloads. The shipping and receiving area, order assembly area, shipping and receiving office, and refuse room were also located on this floor because of their close relationship to other first-floor activities. The floorspace requirements (tables 3, 5, and 6 and pallet dimensions) for these activities were determined at various product volumes within the range prevailing in the case-study plants.

Then, by changing area dimensions, and shifting work stations in relation to aisle requirements, door openings, and location of other activities, a workable first-floor layout was developed for a given product volume. A similar procedure was followed on the second floor for egg grading, packing material storage, office, and employee facilities that involve less activity and smaller floorloads.

After a workable layout was developed for each floor, they were adjusted to the most effective overall layout (fig. 23) for the operating capacities within the volume range and combinations of services being rendered by the case-study plants (table 1).

The potential weekly capacities,[8] rounded to the nearest 100 pounds, for each category were:

Poultry—category No. 1:
- 104,000 pounds of icepacked poultry, of which 30,000[9] could be cut up to specifications.
- 21,600 pounds of frozen poultry.
- 600 cases of shell eggs,[10] all of which could be cartoned or graded and cartoned in the plant.
- 6,100 pounds of print butter.
- 3,600 pounds of processed cheese.

Eggs—category No. 2:
- 1,800 cases of eggs, of which 1,200[10] cases can be graded and packed in the plant.
- 19,000 pounds of egg meat broken out, mixed, canned, and frozen at the plant (produced from 120 cases graded out of the plant egg department and 380 cases of graded breaking stock from outside sources).
- 6,100 pounds of print butter.
- 3,600 pounds of processed cheese.

These volumes then become recommended capacity for the layout. Regardless of category (poultry or eggs), the same basic plant layout can be used efficiently. In this way, the initial building construction can include identical interior features (floor pitch, drains, and partitions).

Plant Site

The selection of the site for a multiple-occupancy warehouse center is generally based on the needs of many individuals handling many different commodities. The choice would be influenced by the availability of a relatively large, accessible parcel of land at or near the outskirts of a large city, the purchase price, and the conditioning cost. The decision to occupy a unit (in addition to the cost) would also be governed by suitability of space to types and amounts of services to be offered, future expansion plans, accessibility to highways, street surfacing within the center, access to railroads, space between warehouses, number and variety of commodities handled by other wholesalers in the center, and auxiliary services such as restaurants, waste disposal (sewerage system and garbage pickup), utility services, and fire, flood, and police protection.

Construction

The first floor and footings suggested are of reinforced concrete, capable of supporting a live load of 225 pounds per square foot. The first floor is continuous at truck-bed height; the smooth, troweled cement surface is pitched one-fourth inch

[8] For container dimensions, weights, pallet capacities, inventory turnover, and the like, for all products and materials, see appendix, p. 38, tables 5 and 6.

[9] This figure might vary greatly, depending on the complexity of the specifications. Many more pounds could be processed if the majority of the volume involved split broilers and many less if the majority was deboned breasts.

[10] Based on a minimum of 30 cases per worker per 7½-hour day.

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to the foot toward trapped floor drains (fig. 23) to carry off waste water in the cooler, order assembly, shipping area, and processing room.[11]

Loading docks are covered with a cantilevered canopy extending 4 feet beyond the dock. The floor surfaces of the docks are sloped one-fourth inch to the foot away from the building. Steel bumpers are bolted to the leading edges. A continuous 2-foot step runs along the front of the docks to accommodate small delivery trucks. Several units share a stairway to the street.

The second floor consists of steel decking on structural steel framing that supports a concrete floor with a smooth, troweled cement finish. It is capable of supporting a live load of 150 pounds per square foot. Stairs lead to the second floor. Shell eggs, packing materials, and supplies are moved between floors by belt conveyor. Windows are located along the front of the building in the office and employee facilities area.

The walls at the front and rear of each unit are 8-inch concrete block. The front is veneered with 4-inch brick on the outside and the rear is insulated on the inside. Partitions between units are 6-inch concrete block. Interior walls are 4-inch concrete block. The interior walls of the processing room, rest rooms, and refuse room have a glazed tile wainscotting.

Two 8- by 8-foot overhead doors at the front of the building serve as the main plant entrance. A refrigerator door at the rear of the building provides access to the storage area from the rear dock and serves as a supplementary plant entrance. Doors leading to and from the refuse room, processing room, and restrooms are equipped with self-closing devices.

The flat roof consists of steel decking on structural steel framing covered with gypsum insulation and tar-and-gravel weatherproofing.

Shipping and Receiving Area

The shipping and receiving area consists of the front and rear loading docks, the order assembly area, and the shipping and receiving office (fig. 23).

The front and rear docks are of reinforced concrete and sloped one-fourth inch to the foot away from the building to allow drainage. The 14-foot dock width allows for free movement of unit load equipment. The canopy over the dock provides shelter for the shipping and receiving operations during inclement weather. Approximately 840 square feet of dock space are provided.

The area inside the two front doors, facing the shipping and receiving office, is for order assembly. Products are moved from the cooler, freezer, processing room, or grading room to the order assembly area before shipment.

The 6- by 8-foot shipping and receiving office, equipped with a standing counter on two sides, and windows on three sides,[12] provides office space for two workers. Sliding glass panel windows in the front and rear partitions permit direct communication with the order assembly area and the processing room. An intercom system provides communication between it and the general office and grading room on the second floor. The location of the shipping and receiving office and communication between it and other key areas in the plant permit close supervisory control and coordination between shipping and receiving schedules and processing operations.

Refrigerated Storage Area

The refrigerated storage area consists of a 45° F. cooler and a −10° F. freezer (fig. 23). The area was designed as an insulated compartment that provides the flexibility of utilizing the entire area as a cooler or varying the size of the freezer to suit the needs of the occupant. The "compartment effect" also reduces refrigeration losses, since the freezer opens into and is partially surrounded by the 45° cooler area. This provides a considerable degree of flexibility and results in lower refrigeration costs.

The smooth concrete floor is pitched one-quarter inch to the foot toward a trapped floor drain.[13] The walls and ceiling are insulated (3-inch cork or equivalent in the cooler and 5-inch cork or equivalent in the freezer) and have a troweled plaster finish, treated to avoid moisture penetration. Steel bumper guards along the wall prevent damage by materials-handling equipment. The ceiling clearances are 11 feet 9 inches in the cooler and 11 feet 7 inches in the freezer.

The cooler provides approximately 760 square feet of refrigerated storage space. The dimensions permit positioning four rows of six pallets each along one side of an 8-foot aisle and a single row of pallet racks along the opposite side for partly loaded pallets of poultry and eggs. Space for a work table allows preparation of small orders of dairy products or transferring breaking stock.[14] Standard 5- by 7-foot refrigerator doors provide access to the cooler.

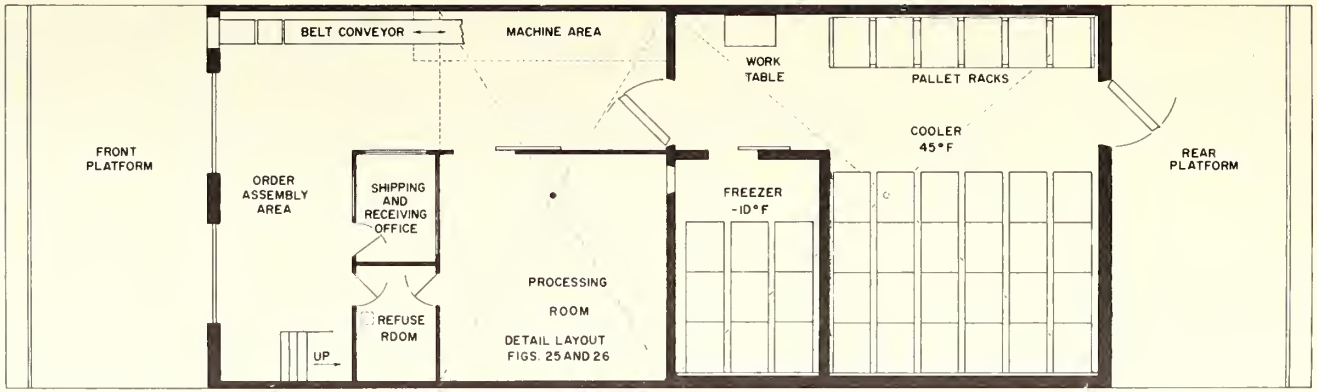
The freezer provides approximately 200 square feet of refrigerated storage space. The dimensions permit positioning three rows of three pallets each along the wall and provide a 5-foot access aisle. If egg meat or poultry is to be frozen, the row of pallets next to the processing room will be replaced with a 24-inch bilevel roller conveyor (fig. 24) and an access aisle. Containers of egg meat or poultry are loaded onto the conveyor through a freezer port from the processing room.

[11] Location of floor drains and direction of floor slopes and high points were carefully arranged so as to fit either a poultry or an egg operation. Exact execution of these design details therefore is highly critical as a construction factor.

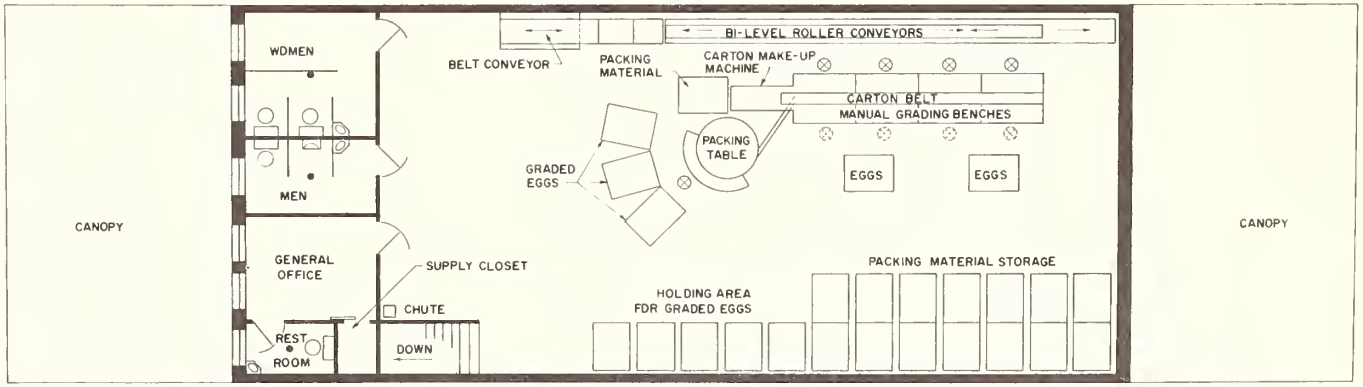
[12] A one-way glass partition permitting a view of processing operations is recommended.

[13] Floor drains are not normally required in freezers. Floor pitch coincides with cooler in the event a freezer is not needed.

[14] Graded breaking stock received from other plants requires removal from cases and repacking in plastic filler flats before entering the breaking room.



PLAN - FIRST FLOOR



PLAN - SECOND FLOOR

LEGEND

● FLOOR DRAIN
⊗ WORKER

SCALE OF FEET
0 1 2 3 4 5 10

FIGURE 23.—Detail layout of a multiple-occupancy warehouse unit for a wholesale poultry and egg distributor operation.

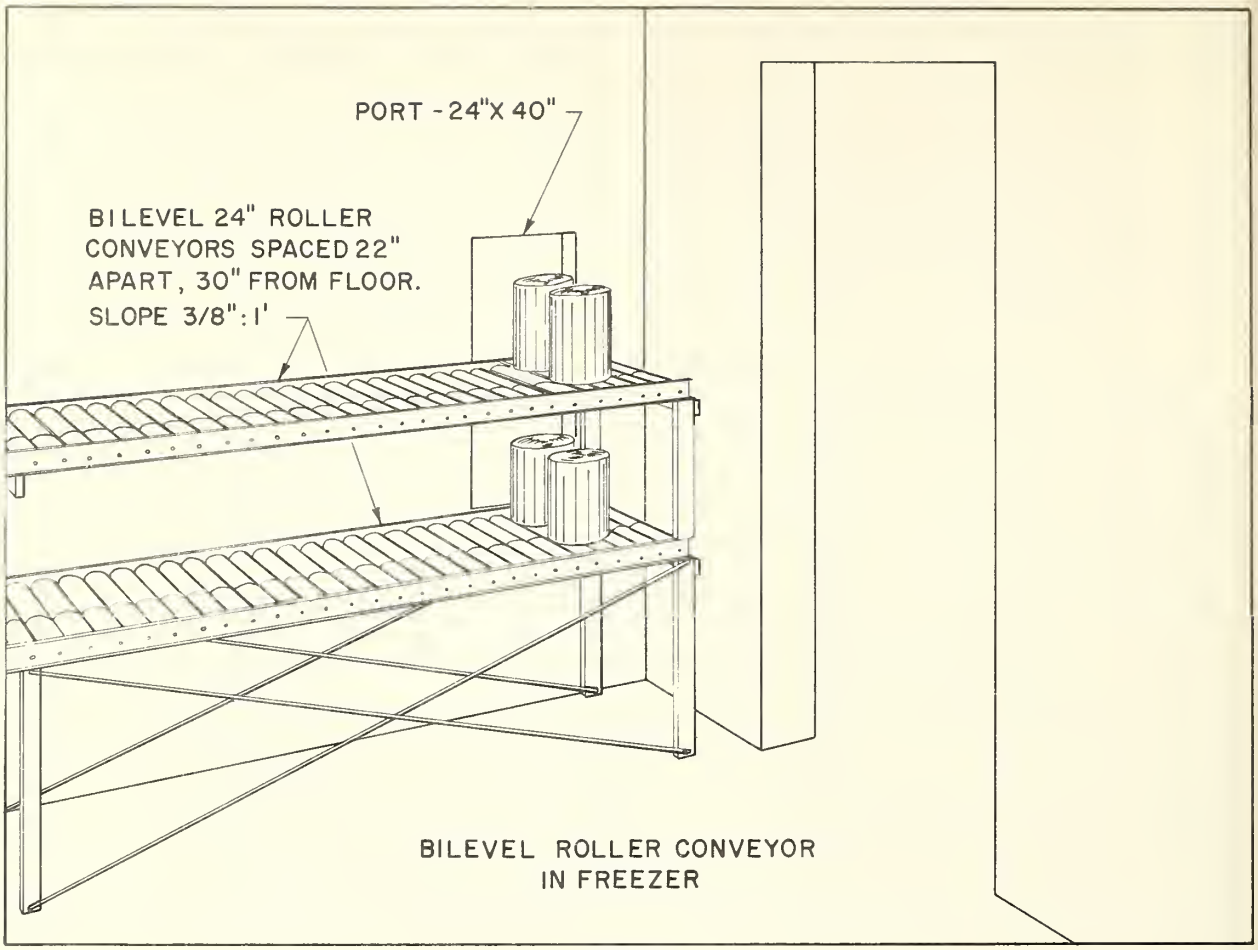


FIGURE 24.

The conveyor has the capacity to hold approximately one-half day's liquid egg production or 1 day's cut-up chicken production when the processing room is operating at capacity. This makes it possible to freeze 1 day's cut-up chicken production on the conveyor or 1 day's liquid egg production on the conveyor and in the aisle adjacent to the conveyor. A ceiling-suspended blower unit provides quick-freezing temperatures. The freezer has a 4- by 7-foot sliding refrigerator door,[15] and the port from the processing room has a 24- by 40-inch refrigerator door, with weighted canvas door curtain.

A guide to refrigeration requirements for each operation category (poultry or eggs) is shown in the appendix page 39, table 7. The refrigeration calculations were based on the product volumes specified for each operation category (page 19) and design conditions for the Washington, D.C., area. The cooler was designed to maintain product temperature at 45° F. The freezer was designed to maintain product temperature at −10° for poultry and to freeze 1 day's production of cut-up poultry or egg liquid in 24 hours and store 1 week's production of egg meats. Refrigeration is supplied by a compressor in the machine area (fig. 23). The refrigeration requirements specified are a guide and are applicable only to product and design conditions specified for this study. Refrigeration engineers should be consulted for each wholesaler's particular needs.

Processing Facilities and Equipment

The processing facilities consist of the first-floor processing room ("wet" operation) and the egg grading and packing area on the second floor. There are approximately 975 square feet of floorspace available for these operations.

POULTRY CUT-UP OR EGG-BREAKING ROOM.—The processing room on the first floor was designed to accommodate either poultry cut-up or egg breaking and canning. The dimensions of the room were determined by the operation requiring the greatest amount of floorspace, the layout of the equipment, and the personnel required to process the volume typical of the case-study plants. Layouts for each type of operation were developed (figs. 25–26). There was very little difference between the two.

[15] A preventive against ice formation at door gaskets is recommended.

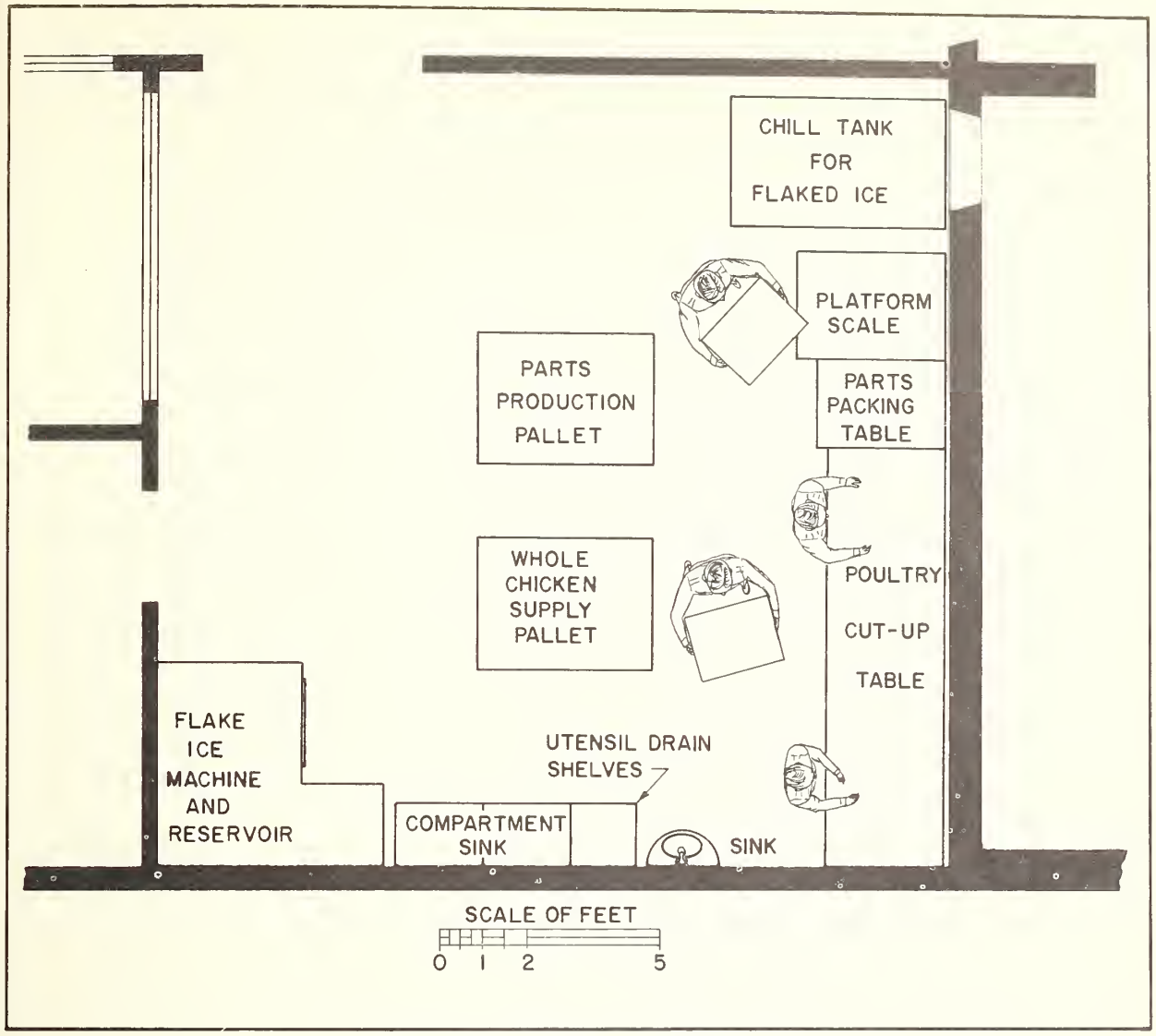


FIGURE 25.—Poultry cut-up room layout.

The room occupies approximately 325 square feet of floorspace. The concrete floor with a smooth, cement troweled finish is pitched one-quarter inch to the foot to a trapped floor drain. The walls are faced with a glazed tile wainscot to a height of 6 feet. Wall surfaces above this height and the ceiling are smooth plaster with a light-colored finish that is impervious to water. Junctions of walls, floor, and ceiling are sealed. The room is air conditioned and is maintained at 70° F.

The doors in the room are self-closing and fit snugly. The processed product is moved directly to the freezer through the freezer port.

The equipment requirements are different for each type of operation, with the exception of the pedal-operated hand basin. Efficient layouts were achieved because room dimensions, wall openings, and the location of water outlets and floor drains were identical.

POULTRY CUT-UP EQUIPMENT AND ROOM LAYOUT.—The location of equipment for an efficient, sanitary poultry cut-up operation is illustrated in figure 25. The basic equipment items include one each of the following: A flake ice machine (2,400-pound-per-day capacity), an ice reservoir (1,350-pound capacity), a platform scale (100-pound capacity), a two-compartment sink, utensil drain shelves, a pedal-operated sink, a parts packing table, a poultry cut-up table, and a poultry chill tank.

The cut-up table, 2¾ feet wide by 9½ feet long (fig. 27), with a stainless-steel working surface pitched and drained to the rear, provides space for three workers. Each station is provided with a vinyl cutting board, a rack with six removable

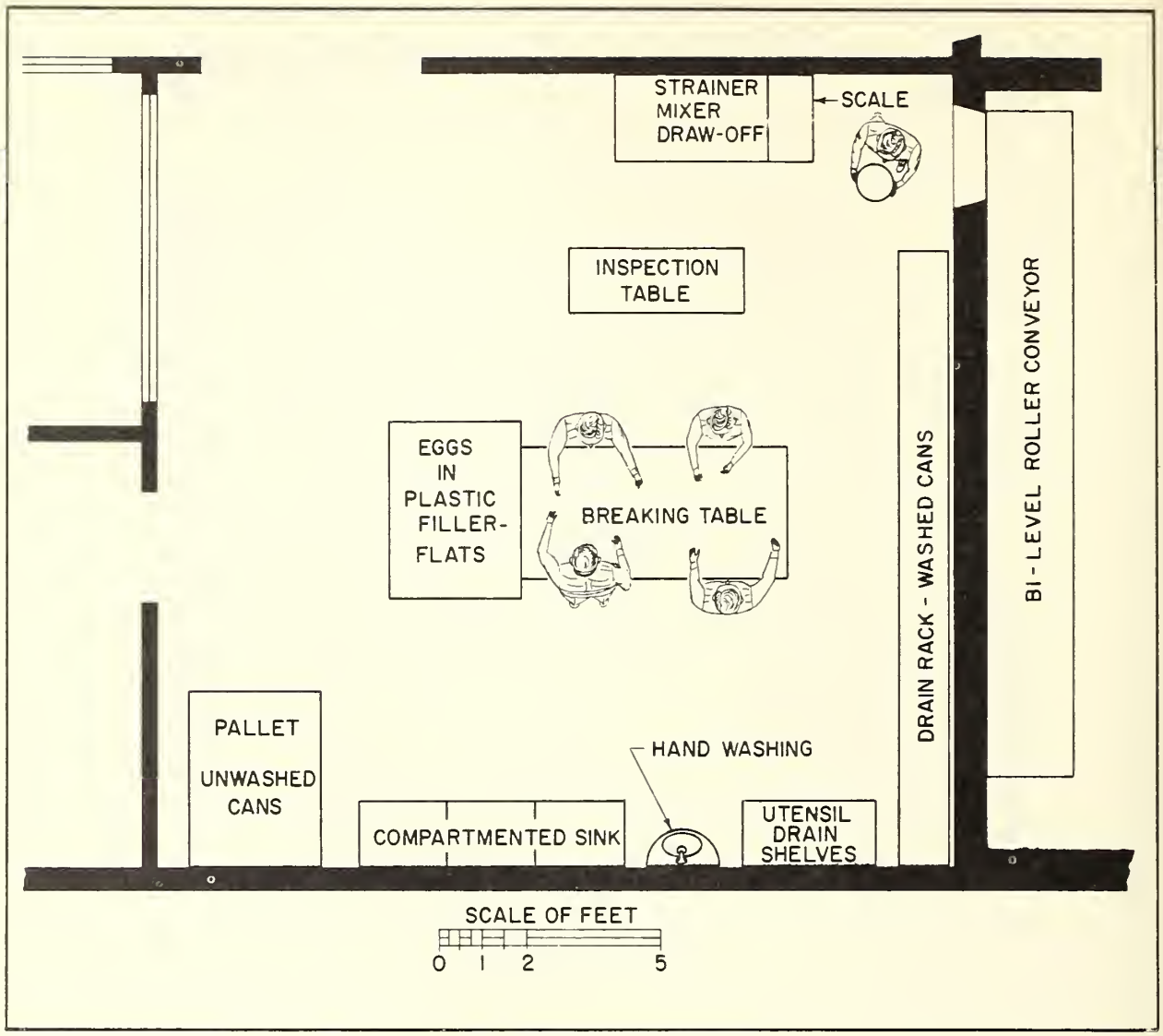


FIGURE 26.—Egg-breaking room layout.

trays for accumulating parts, a set of knives, a knife hone, and a shelf under the table for boxes and packing materials. Water spray nozzles are located between work stations and space for individual bird scales is available for each worker. The drain outlet, rear center, should be screen equipped.

The 100-pound-capacity platform, beam-type scale and parts packing table are positioned to provide work stations for the packer(s) and scaler. This equipment permits the direct movement of specialty cuts to the freezer, through the port, or for icepacking. A portable ice bin (a 750-pound-capacity poultry chill tank that can be removed when poultry is packed for freezing) near the scale provides ice for icepacked poultry. The bin can be refilled as necessary from an automatic flake-ice machine. The ice machine reservoir is located against the wall near the compartment sink. The 1,350-pound reserve plus the daily production provides 2,250 pounds [16] of ice per day, which is sufficient for the requirements of the plant.

The floorspace occupied by the two-section sink, utensil drain shelves, and the pedal-operated sink serves as a "kitchen" or cleanup area. Hot and cold water outlets in the sink and at a hose bib under the sink are for cleanup. The utensil drain shelves provide space for receiving soiled utensils on the bottom shelf and space for the drainage and temporary storage of washed utensils on the top shelf. The pedal-operated hand washing basin has soap and towel dispensers nearby.

[16] Based on 9-hour machine operation at 100 pounds per hour.

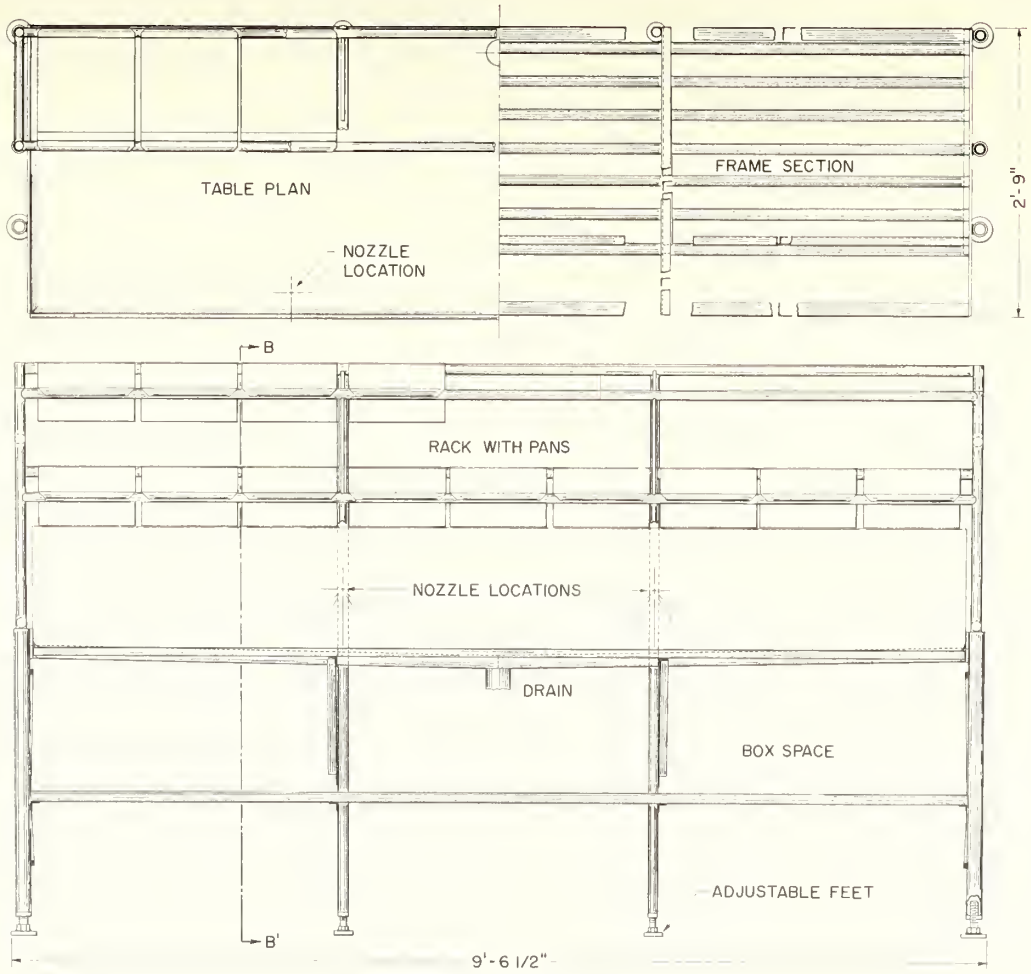


TABLE PLAN
NOZZLE LOCATION
FRAME SECTION
2'-9"
SCALE OF FEET
0
1
2
B
RACK WITH PANS
NOZZLE LOCATIONS
DRAIN
BOX SPACE
ADJUSTABLE FEET
B'
9'-6 1/2"
FRONT VIEW
(FROM "A" BACK)
ADJ. NOZZLE
A
1'-0"
1'-4"
5'-7"
3'-0"
2'-11/2"
SECTION B-B'
POULTRY CUT-UP TABLE

FIGURE 27

The center of the room affords space for pallet loads of incoming products for processing and outgoing processed products. The remaining space provides adequate aisles for workers and movement of unit loads.

Egg-Breaking Equipment and Room Layout.—The location of major pieces of equipment, their work station areas, and relation of location to room fixtures and wall openings for an efficient small-scale breaking operation are illustrated in figure 26. The basic equipment includes a four-station breaking table (stainless-steel top), combination egg-meat receiving hopper, filter, and drawoff unit (stainless steel), an egg-meat scale, a three-compartment sink, utensil drain shelves, a can drain rack, an inspection table (stainless-steel top), and a pedal-operated sink equipped with a soap and towel dispenser.

The kitchen equipment consists of the three-compartment sink (wash, sanitize, and clear-water rinse), utensil drain shelves, and a can drain rack. The equipment is arranged to permit placing a pallet load of unwashed cans on one side of the sink and a drain rack for clean cans inclined toward the canning area on the other side.

The breaking table (fig. 28) is a standard four-station unit, 3 by 6 feet. Auxiliary equipment includes: 18 stainless-steel buckets for egg-meat (9-quart capacity), 4 galvanized-iron cans for shells (30-gallon capacity), 16 stainless-steel cups for liquid eggs, 4 paper-towel dispensers, 2 galvanized-iron shell funnels, 2 galvanized-iron shell tampers, 10 stainless-steel Canadian-type egg-breaking tray sets complete (tray, grid, knife, and trough), 24 galvanized iron leaker trays and 1,200 plastic filler flats.[17]

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Figure 28.—A four-station egg-breaking table equipped for whole egg meat operation.

The breaking table is equidistant from the kitchen area on one side and the canning area on the other. The location permits work station space for each breaker, access aisles to and from work stations, space for an inspection table,[18] and space for a pallet load of breaking stock.

Egg-Grading Equipment and Layout.—Approximately 735 square feet of floorspace on the second floor is provided for egg grading and packing. The floor is smooth troweled cement. The concrete-block walls are painted, and the ceiling clearance is 10 feet. The room is maintained at 70° F. for worker comfort and product holding requirements.

Egg-grading equipment consists of an eight-station manual, double-sided grading line.[19] It is equipped with a 12-inch belt for cartons, running the length of the line, a carton closer and sealer, and a 5-foot rotary packing table (fig. 23). When chipboard cartons are used, a carton makeup machine at the end of the grading line sets up cartons automatically and ejects them onto the return side of the carton belt. The cartons move to the grading stations for removal by the graders. When molded pulp cartons are used, a supply for each grader is furnished from overhead magazines. (fig. 29).

Manual equipment was selected because of low initial cost,[20] minimum space requirements, and flexibility in switching from sample inspection and packing (category No. 1) to full grading and packing (category No. 2). In addition, the number of graders can be increased to eight, as the quality and volume requires, with little change in floorspace demands. This provides an economical capability for packing only or for a full grading and packing operation up to 1,200 cases per week—the volume potential of the line.

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[17] Includes supply for egg graders and work table in cooler.

[18] An inspection table is not required if breakers are qualified to check and inspect their own breakout. However, if the egg quality is good and three or four well-trained breakers are being used, it is more efficient to use an inspector who also serves as a canner and kitchen worker.

[19] Only one side (four stations) needs to be operated at the volume level indicated for category No. 1.

[20] If any of the mechanized lines are considered, thought should be given to quality problems, initial investment cost, maintenance, floorspace, and full equipment and crew utilization.

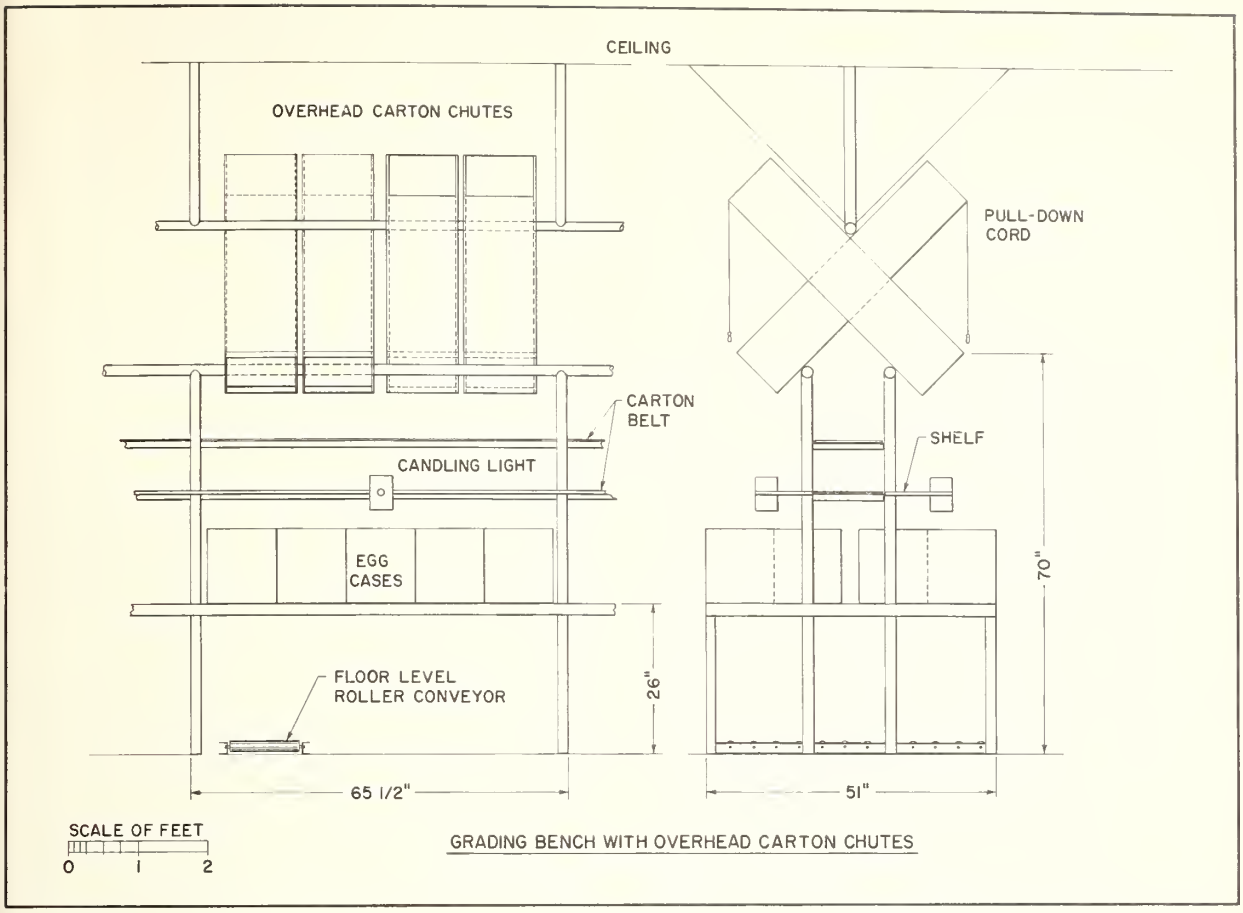

FIGURE 29

Dry Storage Area

An area of 215 square feet of floorspace on the second floor is provided for packing materials storage. This allows sufficient space for positioning two rows of seven pallets along the wall opposite the grading line. (One month's supply of packing materials when the major operation involves poultry processing or 1 week's supply when the major operation involves egg grading and packing.)

A 6-foot aisle provides adequate access to the storage area for a manual pallet transporter.

Machine Area

The machine area should supply sufficient space for a water heater and the refrigeration and heating equipment. The equipment should be spaced and shielded for easy access for servicing and air circulation around the machinery (fig. 30). Wall space in this area can be used for the power panel and utility meters. The layout in figure 23 sets aside an area of 80 square feet for this purpose on the first floor, under the inclined belt conveyor. This location reduces the distance that refrigeration and hot water are piped and provides easy access for maintenance. The area should be adequately shielded as a safety precaution to personnel and equipment.

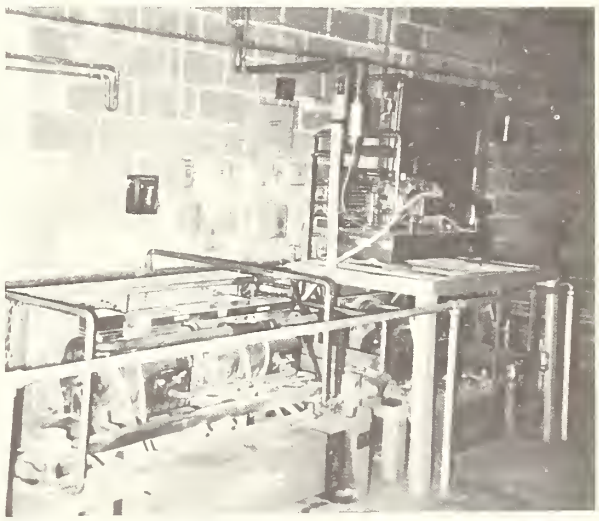

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FIGURE 30.—Refrigeration equipment properly spaced and shielded.

Employee Facilities

In contrast to past practice in many wholesale facilities, ample, well-lighted, and ventilated space has been set aside for plant personnel. Approximately 170 square feet on the second floor, adjoining the office area, are designated for employee facilities, consisting of a restroom for male employees and a combined locker room and restroom for female employees. Easy access tends to reduce extended absence from work stations and proximity to the office facilitates management's control over workers.

The women's locker room occupies 105 square feet and is equipped with two toilets, a wash basin, and space for a couch and garment rail. The toilet area is separated from the locker and rest area by a partition.

The men's restroom occupies 65 square feet and is equipped with a toilet, a urinal, and a wash basin. Restrooms are ventilated to the outside by exhaust fans and window openings. If management employs male workers only, the space occupied by the women's locker room can be converted into a lunchroom [21] or a dressing room for male employees.

The concrete floors with smooth, troweled cement finishes are pitched one-fourth inch to the foot toward trapped floor drains. Walls are smooth plaster, painted a light color and are tile wainscotted to a height of 6 feet. The location of the fixtures within the rest rooms permits common plumbing outlets.

These facilities are adequate for a maximum of 15 male employees and 15 female employees. In addition to these recommendations, management should also consult local health authorities when planning the restroom area.

Office Space

The general office occupies 135 square feet of floorspace on the second floor. A restroom for office personnel and a closet for office supplies are included. The general office is primarily the bookkeeping department and the manager's office. An intercom system provides communication between the general office, the shipping and receiving office, and the processing areas.

Refuse Room

A considerable amount of refuse accumulates in a normal day's operation in this type of facility and provisions for its orderly disposal is necessary for a sanitary and efficient operation. The room set aside for this purpose occupies 65 square feet on the first floor. It is convenient to the front dock on one side and opens on the processing room on the other. A gravity chute from the second floor (fig. 23) is suggested for the movement of refuse from the grading area to the refuse room. The chute deposits the refuse in cans positioned under it. Cans of refuse from the processing room are carried or transported by handtruck to the refuse room. Because watertight refuse containers are used, the floor has no drain. However, the floor surface is sloped toward the front dock so as to facilitate water runoff during daily cleanup. The room is vented by exhaust fan through the room on the second floor.

Plant Utilities

Electricity, gas, and water controls are located in the machine area for convenient control and maintenance.

Overhead fluorescent lighting is recommended for the processing room, office, and employee facilities. Overhead incandescent lighting is suggested for the remainder of the plant and the loading docks. Switches are located to provide selective lighting, and electrical outlets are conveniently arranged throughout the plant to meet the needs for electric appliances and equipment. The two-way intercommunication system connects the general office, shipping and receiving office, and the processing areas.

Water supply lines are confined to the front of the building. All areas that require water are relatively compact; this reduces construction costs. Hot and cold water outlets, in addition to those in hand basins and utensil sinks, are provided for cleanup in the processing room, refuse room, and restrooms. Water should be of drinking quality from a city-approved water supply.

The heating and cooling system is capable of maintaining room temperature at 70° F. throughout the plant in summer and winter. The processing room and the entire second floor are heated and cooled by overhead ducts from a central packaged heating and cooling unit in the machine area. A guide to heating and refrigeration capacities is in table 7, appendix, page 39. Detailed heating, air-conditioning and refrigeration estimates and recommendations should be obtained from local contractors to determine the capacity suited to the climate in the area in which the plant is located.

Processing Operations

The recommended facilities permit either egg breaking or cutup poultry processing work on the first floor and egg grading and packing on the second floor. The operating combinations afford the flexibility that is considered essential to a poultry and egg wholesale operation.

Poultry Cut-up Operation.—The layout of the processing room (fig. 25) for a poultry cut-up operation shows the capacity for flexibility, reported in the section on layout. All the case-study plants cut icepacked poultry into parts on a custom order basis, but the number of part segregations that were made varied from order to order and plant to plant. The maximum possible number of part segregations occur when the chicken is cut into its five component parts (breast, drumsticks, thighs,

[21] A lunchroom was not provided in this plant layout because food-distribution centers are normally served by a number of restaurants and catering services.

wings, and back). The layout was developed to handle the maximum number of parts.

Pallet loads of whole chickens are transported from the cooler to the cut-up room and spotted behind the workers. A pallet for the temporary storage of parts is also provided.

The worker obtains a full box of chickens from the pallet and dumps the contents of the box onto the cut-up table (fig. 27) at his work station. Each chicken can then be cut into the specified number of parts and the parts are placed into one of the six designated parts pans banked above the cutting table for holding until packing. Pans would be designated for breasts, drumsticks, thighs, wings, and backs. The sixth pan is necessary for accumulating giblets when a parts order excludes this item.[22] The parts are allowed to accumulate until the pans are filled.

When chickens are cut into five parts, three open boxes are placed on the rack under the cut-up table (one box next to each cutter) and two open boxes are placed on the parts packing table for receiving parts. The workers remove the parts pans from the rack as they are filled and pack the parts into the box designated for that part.

As the boxes are filled, the packer transports them from the rack under the cut-up table or the parts packing table to the scale. The packer places the box of parts on the scale pan, notes its weight, and records it on the box. The box is topped with about 25 pounds of flaked ice from the chill tank next to the scale, closed, and transferred to the pallet for parts to await movement to the order assembly area or the cooler. Parts to be frozen are handled in the same manner through the weighing operation, except that they may be packed in subcontainers or individually wrapped before packing. After the container is closed, it is transferred from the scale through the port to the bilevel roller conveyor in the freezer. The chill tank for ice would not be required if the product were to be frozen, and would be removed to provide access to the freezer port.

The packing operation described requires a complex work station arrangement. Orders involving an exact weight per chicken, individual cut-up chickens, half chickens, breasts with wings attached, and the like, could be handled with the same work station layout by utilizing more than one parts pan for each segregation.[23]

During the evaluation of existing wholesale distributor facilities, one plant was deboning turkeys [24] and another was preparing smoked turkey. It should be pointed out that, although these specialty services were not included in the operations description in this report, the facilities, equipment and room layout, and dimensions shown will handle either operation with only minor modification and very little additional equipment.

Egg Grading Operation.—Ungraded eggs are unloaded from incoming trucks by conveyor direct to the grading room on the second floor (fig. 23) or may be transported in unit loads to the cooler on the first floor to await order assembly or grading and packing. When moved direct to the second floor, they transfer to the 30-case-capacity gravity roller conveyor behind and parallel to the grading line,[25] furnishing a supply of eggs to graders on the double-sided grading bench.

The double-sided bench allows the flexibility of using one or both sides of the line, depending on volume. Although an additional handling is required from time to time with this arrangement, it is offset by the flexibility afforded. The graders on the side of the grading line adjacent to the roller conveyor obtain full cases of ungraded eggs from the conveyor as needed and transfer them to the grading bench. Empty cases are moved to the packing area on an overhead roller conveyor above the incoming eggs. Graders on the opposite side obtain cases of ungraded eggs from pallet loads behind them. As cases of ungraded eggs are needed they are transferred to the grading benches by the graders. Empty cases are placed on pallets vacated by ungraded eggs.

The graders remove the eggs from the cases and grade or pack them (or both) into cartons that hold 1 dozen or filler flats that hold 2½ dozen. Cartons are pushed onto the carton belt and move through the closer and sealer onto the rotary packing table. Eggs that are graded into filler flats are packed by the graders into cases that hold 30 dozen.[26] The graders on the conveyor side of the line push full cases of bulk-packed eggs as they are graded to the opposite side of the grading line on a floor-level roller conveyor (fig. 29), and they are transferred periodically to pallets spotted along the length of the line. The graders on the same side of the line as the pallets transfer full cases directly to pallets as they are packed. The worker at the carton packing table packs 1-dozen cartons into 30-dozen-capacity cases. Cases of eggs in cartons are placed on pallets adjacent to the work station. When a pallet load is accumulated it is moved to the holding area for graded eggs or directly to the conveyor for movement to the cooler, the order assembly area, or a truck. When a pallet load of bulk-packed eggs has accumulated alongside the line, the carton packer handles them in a

[22] A frequent practice involves accumulating a supply of giblets and then combining necks, hearts, and gizzards with backs for a commercial soup stock pack, and packing livers as a select parts item.

[23] Because of the great variety and difference in time requirements for preparing many cuts, a broad volume range was used, p. 19.

[24] With turkeys, the rated tonnage capacity is increased.

[25] Manual grading and packing have been recommended for wholesale needs because of variable product quality, small initial investment, and operational flexibility (for production estimates, p. 19). If mechanized equipment is considered, a constant supply of uniformly fine quality eggs is essential for maximum utilization of equipment.

[26] Eggs that are to be broken out and canned are packed in plastic filler flats for movement to the breaking room or for temporary storage in the cooler.

similar manner, except that breaking stock might move directly to the work table in the cooler for transfer to the breaking room.

The carton packer also supplies the packing materials. He moves a pallet load of packing materials from the storage area to a point near the packing table. Cartons are fed into the carton makeup machine and are discharged on the return or top side of the carton belt and move along the length of the line to each grading station; or cartons are fed a bundle at a time into carton chutes at each grading station (fig. 29). The graders remove the cartons from the belt or chute as needed. As filler flats are removed from cases during packing, they are stacked on a shelf at each work station for periodic pickup by the carton packer. Empty cases are returned to the carton-packing table by roller conveyor or by the pallet load. Whether packing materials are reused or held in temporary storage depends on the nature of the packing operation. The carton packer services the grading stations for the supply and disposal task.

Undergrade eggs for breaking stock are placed in plastic filler flats as previously mentioned. Wholesalers not operating a breaking room would bulk-pack (in 30-dozen case lots) the breaking stock for sale to a company with a breaking room.

The holding area allows accumulation of graded eggs before moving them to the first floor. This permits flexibility in scheduling the efficient utilization of manpower and equipment during slack and rush periods. It can also provide temporary storage space for incoming eggs awaiting grading. These features all tend to increase overall operational flexibility.

Egg-Breaking Operation.—The layout of the processing room for an egg-breaking operation (fig. 26) shows a breaking table with four work stations and equipment for processing and canning whole eggs.[27] Based on the shell egg quality and egg size usually handled for this purpose by wholesale distributors, it is estimated that 100 cases of shell eggs can be broken out and canned in 1 day. This volume should yield 3,500 to 3,900 pounds of whole egg per day.

Breaking stock from the plant grading room and from outside sources is held in the cooler until needed. Upon demand, filler flats are stacked on a pallet at the cooler work table. Here graded breaking stock from outside sources can also be transferred to plastic filler flats if they were not so packed at origin.

A suggested work station layout (fig. 31) was developed for this operation.

A method for performing the job [28] is: Remove a full case of breaking stock, packed in molded pulp filler flats,[29] from pallet A to low transfer bench at B; open case, remove top filler flats to temporary storage on work table at C; remove any leakers or eggs with adhering dirt and place in leaker tray at D; remove two plastic filler flats from supply stock at E and place on top of eggs at B; remove layers of eggs from B (with plastic flat on top of layer and fiber flat supporting eggs); invert layer of eggs and position at F; remove fiber filler flats and store at C; repeat until stack of six layers of eggs in plastic filler flats is accumulated; shift stack to back of table; repeat transfer cycle until case is empty; place stacks of transferred eggs on pallet G; repeat until pallet is loaded. The packing materials are returned to empty cases (after grading out soiled or torn materials) and stacked on pallet A as space is made available. A container for smashed eggs or soiled packing materials should be available under the work table. It is suggested that pallet loads of transferred eggs be confined to a maximum equivalent of 12 cases.

This operation provides a final inspection of breaking stock before it goes to the breaking room, eliminates the need of handling individual eggs, permits holding cases of eggs in the cooler, eliminates the hazard of bringing soiled or dirty packing materials into the breaking room, and greatly reduces breakage resulting from stacking quantities of loose eggs in a bucket or basket.

Eggs in plastic filler flats are transported from the cooler to the breaking room in pallet-load quantities and spotted at the end of the breaking table (fig. 26). This location is convenient to all the breakers.

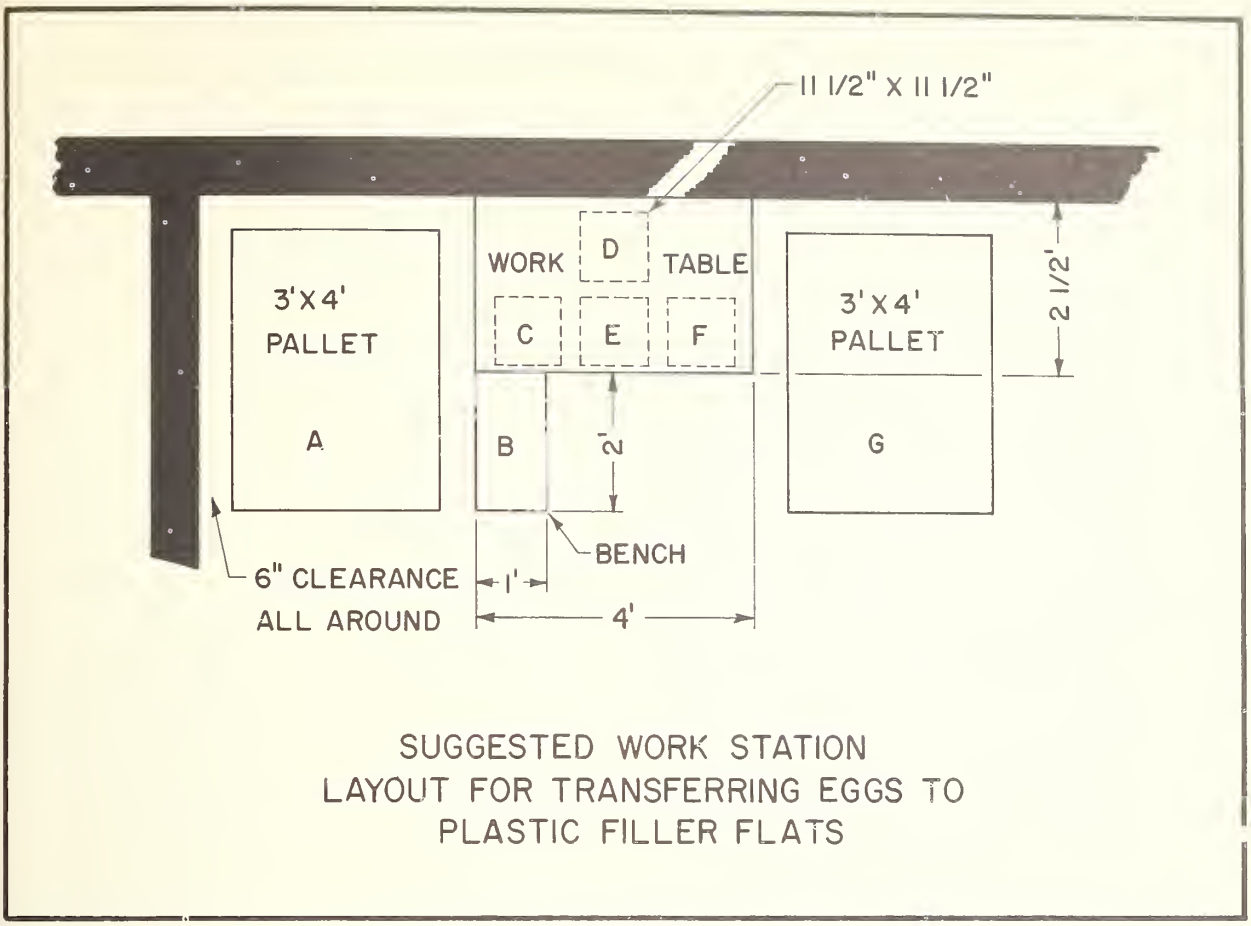
A breaker obtains a stack of six plastic filler flats of eggs from the pallet and places them on the table at his work station. Eggs are broken out into egg-meat buckets and observed visually and organoleptically in rapid succession. Empty shells are discarded into the shell funnels and accumulate in shell cans under the table between breaking stations. When a bucket is filled with liquid it is carried to the central inspection table where it receives a final inspection before it is emptied into the filter-mixer-drawoff unit. A clean bucket is obtained from the drain rack en route back to the work station. When unacceptable eggs are encountered they are denatured in a container under the utensil drain shelves and soiled utensils are replaced with clean ones. Empty filler flats are nested in stacks for washing and returned to the grading room or cooler work table at the end of the day.

A shell tamper (generally within reach through

[27] Sufficient space is available for additional equipment needed for separating whites and yolks or preparing special formula mixes. However, it is recommended that experience be acquired in a whole egg operation before considering any of the egg product specialty items.

[28] This work can be performed intermittently by one of the breakers, graders, or workers performing materials-handling tasks. This task can also be handled by the shipping and receiving crew in the afternoon, transferring and storing pallet loads (in the pallet racks) sufficient for the next day's operation.

[29] This would be graded breaking stock from outside sources. Breaking stock from the plant operation would be packed in plastic filler flats in the grading room.



SUGGESTED WORK STATION
LAYOUT FOR TRANSFERRING EGGS TO
PLASTIC FILLER FLATS

FIGURE 31.

the shell funnel) is used periodically to compress the empty egg shells; this reduces the number of trips to the refuse room for waste disposal.

The inspector serves as canner, scaler, storage man (handling tins of egg meat in freezer), and equipment and can washer, and periodically supplies shell eggs and cans.

The liquid is strained, churned, and drawn off when approximately 30 gallons of liquid have accumulated in the filter-mixer-drawoff unit.[30] Liquid is drawn off into 30-pound capacity tins positioned under the gate valve on the scale weighing platform. The container is capped and transferred through the freezer port to one of the bilevel roller conveyors (fig. 24) for freezing. The bilevel, 24-inch roller conveyor is capable of holding 72 cans of egg meat, when fully loaded, which is the equivalent of about 56 cases of shell eggs. The conveyor holds ½-day's production when the egg breakers are operating at maximum capacity. It is recommended that this quantity be then stacked on the floor—well spaced to attain a −10° F. temperature—in order to make way for production during the rest of the day. The following day the entire previous day's production will be solidly frozen and can be stacked for storage in a solid stack.[31]

Unwashed cans from the second-floor dry storage area are moved to the first floor by the conveyor and stacked on pallets of 60 cans each. They are transported to the breaking room and placed next to the sink (fig. 26). Periodically, the inspector washes, sanitizes, and rinses a supply of containers (30-pound cans). After draining them, he places them on the inclined can rack that terminates near the scale platform. As soiled breaking equipment accumulates on the bottom shelf of the utensil drain rack, it is washed, sanitized, rinsed, and placed on the top shelf ready for reuse. In order to enable the inspector to complete the many short tasks in addition to inspection, it is important that trips to various parts of the room (or plant) be kept at a minimum. The cycle of operations should always begin by inspecting all the liquid available for inspection,

[30] Because of more rapid movement of whites through the strainer, the first 15 or 20 pounds of liquid drawn off are usually returned for recirculation through the unit in order to avoid a low solids count in the first cans packed.

[31] Before stacking solid, the most recently canned product should be inspected for acceptability of the freeze.

BN–18746

FIGURE 32.—A straddle-type electric high-lift pallet transporter high stacking a pallet load of packing materials.

then canning, washing utensils (or cans), and returning to inspection. Jobs occurring infrequently, such as obtaining cans or eggs or stacking packed egg meats, should be scheduled for periods before or after breaking operations.

Materials Handling

The selection of the type and quantity of materials-handling equipment for an efficient wholesale poultry and egg distributor in a multiple-occupancy warehouse should be based on:

- Volume, weight, and characteristics of the products handled, including perishability and fragility;
- Floorloads;
- Transport distances;
- Frequency of movement;
- Aisle widths and ceiling heights;
- Container characteristics, such as stackability;
- The size and makeup of orders that are involved; and
- The overall plant layout.

The recommended materials-handling equipment (table 8, appendix, p. 39) was selected on the basis of operational flexibility in addition to the above factors. To utilize the equipment effectively, the movement of products and materials should be as nearly as possible in unit load quantities, such as those specified in table 5, appendix, p. 38.

EQUIPMENT.—A reversible, inclined, 24-inch belt conveyor moves one-unit quantities of materials and product between the first and second floors. Twenty feet of portable 24-inch roller conveyor, in conjunction with the belt conveyor, moves the product directly from trucks at the front dock to the second floor or from the belt conveyor into the truck. Cases of eggs move from the belt conveyor onto the 24-inch gravity roller conveyor that extends the length of the grading line on the second floor. The conveyor has the capacity to accumulate one pallet-load equivalent (30 cases) of ungraded eggs without rehandling. A 12-inch gravity roller conveyor (above the conveyor for incoming eggs) moves empty cases from the grading benches to the packing area. A bilevel 24-inch roller conveyor in the freezer is provided for receiving and holding the production from the processing room.

Double-entry 36- by 48-inch pallets are handled by a straddle-type electric high-lift pallet transporter (fig. 32) and manual pallet transporters for the movement of products and materials throughout the plant. The electric straddle-type pallet transporter provides the capability of utilizing the high ceilings in the cooler. Two-wheel handtrucks supplement the other equipment in moving loads that are less than a unit-load quantity.

Bridgeplates are recommended to facilitate the movement of materials-handling equipment into and out of trucks.

OPERATION.—Incoming trucks can be unloaded at the front or back dock, depending upon the time of arrival and nature of the delivery. Perishables for cooler or freezer storage can be delivered at the back dock, placed on pallets, and moved into the cooler or freezer by motorized pallet transporters and high-stacker or manual pallet transporter. If large shipments are involved or existing inventories so require, receipts can be high-stacked.

Shipments of eggs for immediate grading, delivered at the front dock, are conveyed directly to the grading line on the second floor. Thirty cases of eggs at a time can accumulate on the roller conveyor near the grading line. Quantities in excess of this number are palletized and moved to temporary storage. Graded breaking stock from outside sources are palletized and moved to the cooler for holding. When needed for breaking, they are withdrawn and moved to the work table in the cooler (fig. 31), transferred to plastic filler flats and moved to the breaking room. Packing materials are returned to the cases and moved to the storage or packing area on the second floor by conveyor.

Small quantities of perishables (butter, cheese, and breaking stock in plastic filler flats) are palletized and high stacked in the cooler pallet rack (figs. 23 and 33).

Incoming nonperishables, such as packing materials, should be delivered at the front dock only, moved directly from the truck to the second floor by belt conveyor, palletized, and transported to the dry storage area by manual pallet transporter. Delivery at the back dock requires transportation through the cooler to the conveyor in front of the building.

Refuse (egg shells or poultry scraps and discarded packing materials) is accumulated in 30-gallon containers equipped with tight-fitting covers. It is transported from the processing room to the refuse room periodically by two-wheel handtrucks. Waste material from the second floor is removed by a gravity chute positioned over a container. Refuse accumulates in the refuse room (fig. 23) until the end of each day's operation and is then moved to the front dock for pickup.

The materials-handling operation on the first floor involves movement of pallet loads between the cooler, order assembly area, and processing area, and from the processing area to order assembly area, freezer, or cooler. Order assembly may involve pallet loads of one item from any one operation, or may involve a number of different items assembled on one pallet moved from place to place to order assembly area by power transporter. Single items for individual orders may be handled by handtrucks.

On the second floor, packing materials are withdrawn from dry storage in pallet-load quantities by manual pallet transporter, two or three bundles at a time, by two-wheel handtruck, or one bundle at a time manually, depending upon the need. Graded eggs are accumulated in pallet loads in the second-floor holding area and then move to the first floor by belt conveyor. Here, they move direct to a truck, or are placed on pallets for movement to the order assembly area or to cold storage.

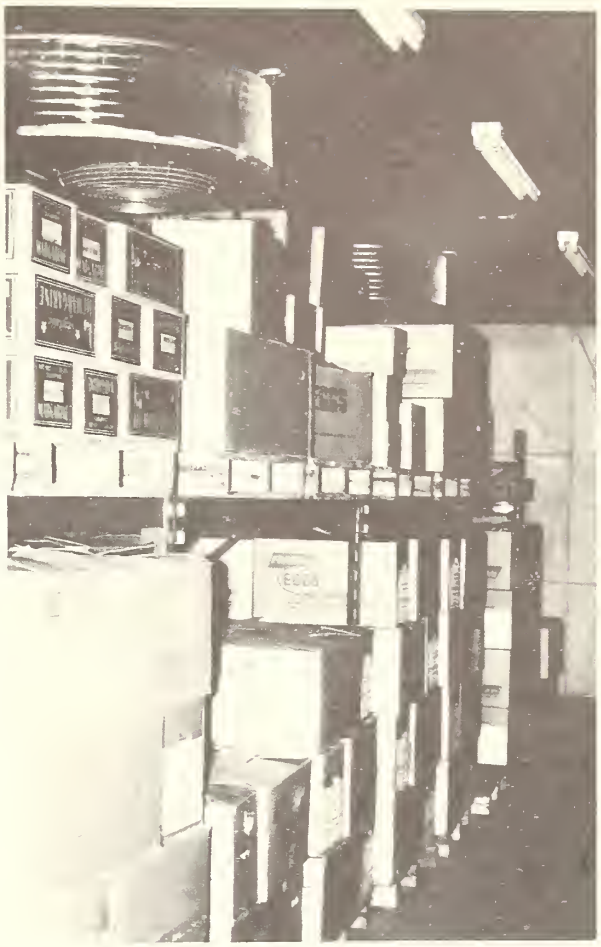


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FIGURE 33.—Pallet racks help conserve cooler floorspace because pallet loads that are of less than maximum size can be stacked one over the other.

Recommended Crew Size

In order to realize the most complete crew utilization, operations other than order assembly, shipping, and product processing can be handled most effectively after the last delivery truck has been dispatched (generally shortly after lunch). Receiving can then be done without congestion. Graded eggs can move from the second floor to the cooler and ungraded eggs from the cooler to the second floor for the next day's operation. A thorough plant cleanup is performed at the end of the day.

To maintain a weekly wholesale distribution of about 75,000 pounds of icepacked poultry, and to prepare 30,000 pounds of poultry cut to specifications, grade or pack (or both) 600 cases of eggs, and assemble a small supply of miscellaneous items, such as butter and cheese, requires a crew of 13 (table 2). The volume of poultry that can be cut up in a day can be greatly increased if the specifications require simple processes, such as splitting or quartering. If the majority of the processing involves complex operations, such as filleting breasts, the capacity will be somewhat less than 75,000 pounds.

In maintaining a weekly distribution of 1,800 cases of eggs, of which 1,200 can be graded or packed in cartons, or both, 19,000 pounds of egg meats that are processed and frozen at the plant, plus a small amount of cheese and butter, a crew of 19 is required (table 2). The breaking-room crew size is based on a capacity operation. If less than the rated capacity of the room is required, it should be reduced in increments of 1 day's capacity. If, at certain times of the year, breaking operations are not necessary beyond the 1 day per week, the plant manager should consider using four egg graders to man the breaking room for the 1 day. The plant crew size and egg grading room capacity would be reduced correspondingly.

Conclusions

1. Because of the age, location, design, and type of construction of many poultry and egg wholesalers' warehouses, remodeling was not considered feasible. These factors would not allow the wide variety of products and services that would be possible in newer, efficiently designed, well-constructed buildings in convenient locations.

2. An efficient, economical, and extremely flexible layout can be built that is capable of accommodating the volume of business and principal combinations of services currently being offered by wholesale distributors. The layout can be fitted into a building with dimensions similar to those of multiple-occupancy warehouses that appear in new wholesale food-distribution centers, if the building is a two-story structure that provides the recommended floor pitch and drainage facilities.

Recommendations

Poultry and egg wholesalers who must relocate because of outdated warehouses and traffic-congested areas, and whose operations and services are similar to those described in this study, should consider:

1. Relocation in a well-designed and constructed multiple-occupancy warehouse unit in a carefully planned metropolitan wholesale food-distribution center.

2. Selection of a combination of services, product volume level, and operating schedules that will fully utilize the capacity and flexibility of the facilities.

3. Provision for refrigeration capacity capable of meeting the freezing and cooling requirements for the services to be rendered.

4. A larger unit or a detached structure [32] if the present or future combinations of processing services or volume of product handled materially exceeds the rated capacity of the facilities proposed in this study.

[32] See footnote 6, p. 15.

Appendix

TABLE 2.—*Suggested crew makeup for a poultry and egg wholesale multiple-occupancy warehouse at volumes and service categories specified* (*p. 19*)

Job and location	Number of workers	
	Poultry category	Egg category
Salesman,[1] general office	1	1
Bookkeeper-clerk, general office	1	1
Superintendent-salesman-handler, shipping and receiving office	1	1
Handler-clerk, shipping and receiving office	1	1
Poultry cutter, processing room	3	----
Poultry packer-handler, processing room	1	----
Egg breaker, processing room	----	4
Canner-handler-kitchen worker, processing room	----	1
Grading room foreman-inspector, egg grading room	1	1
Egg grader, egg grading room	[2] 3	8
Packer-handler, egg grading room	1	1
Total personnel	13	19

[1] The plant owner or manager generally serves as a salesman.

[2] The grading room foreman-inspector would serve as a part-time grader because of the limited supervision and inspection required for this size and type of egg grading or packing, or both, operation.

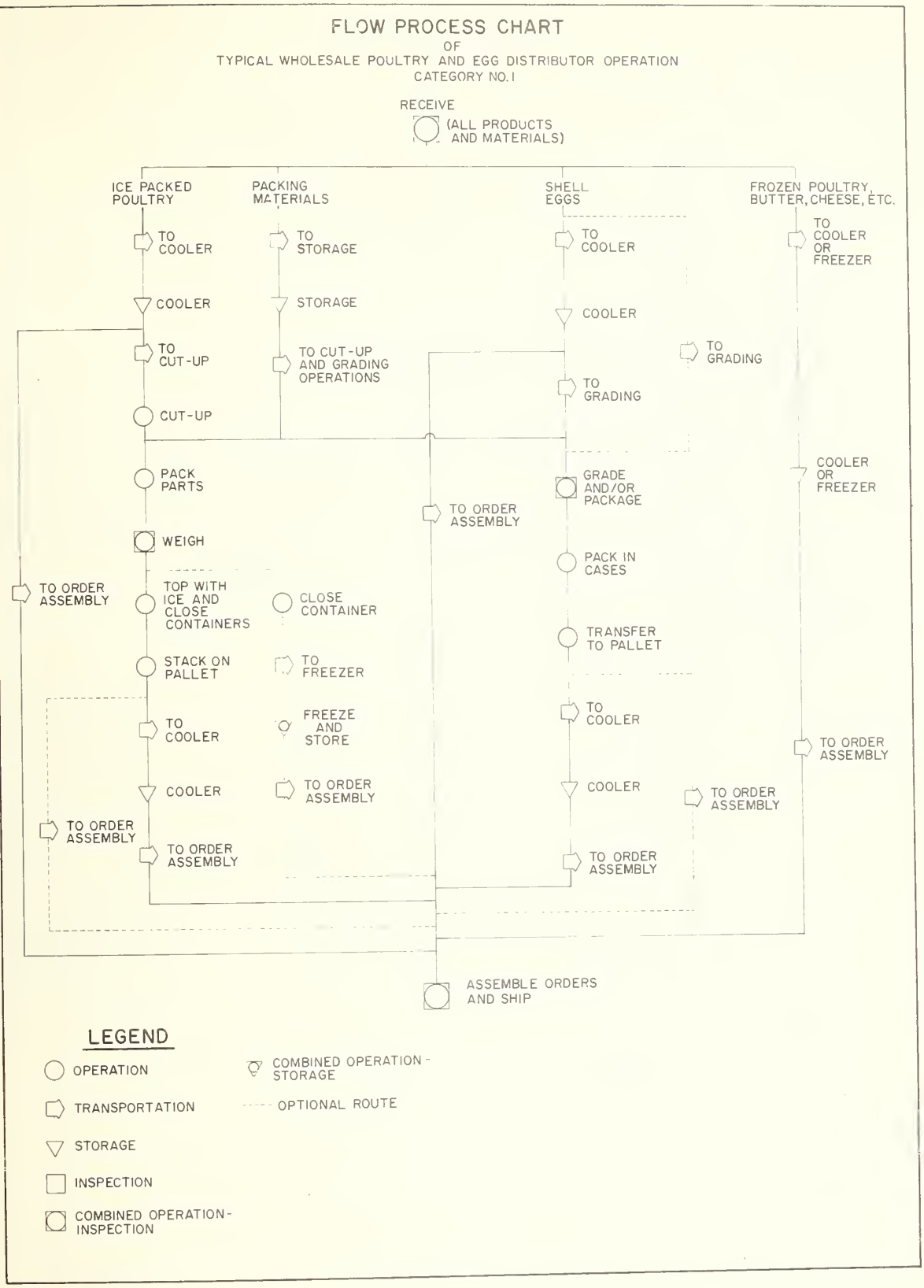
FLOW PROCESS CHART
OF
TYPICAL WHOLESALE POULTRY AND EGG DISTRIBUTOR OPERATION
CATEGORY NO. I
RECEIVE
(ALL PRODUCTS AND MATERIALS)
ICE PACKED POULTRY
PACKING MATERIALS
SHELL EGGS
FROZEN POULTRY, BUTTER, CHEESE, ETC.
TO COOLER
TO STORAGE
TO COOLER
TO COOLER OR FREEZER
COOLER
STORAGE
COOLER
TO CUT-UP
TO CUT-UP AND GRADING OPERATIONS
TO GRADING
TO GRADING
CUT-UP
PACK PARTS
GRADE AND/OR PACKAGE
COOLER OR FREEZER
TO ORDER ASSEMBLY
WEIGH
PACK IN CASES
TO ORDER ASSEMBLY
TOP WITH ICE AND CLOSE CONTAINERS
CLOSE CONTAINER
TRANSFER TO PALLET
STACK ON PALLET
TO FREEZER
TO COOLER
FREEZE AND STORE
TO ORDER ASSEMBLY
COOLER
TO ORDER ASSEMBLY
COOLER
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
ASSEMBLE ORDERS AND SHIP
LEGEND
OPERATION
TRANSPORTATION
STORAGE
INSPECTION
COMBINED OPERATION - INSPECTION
COMBINED OPERATION - STORAGE
OPTIONAL ROUTE

FIGURE 34.

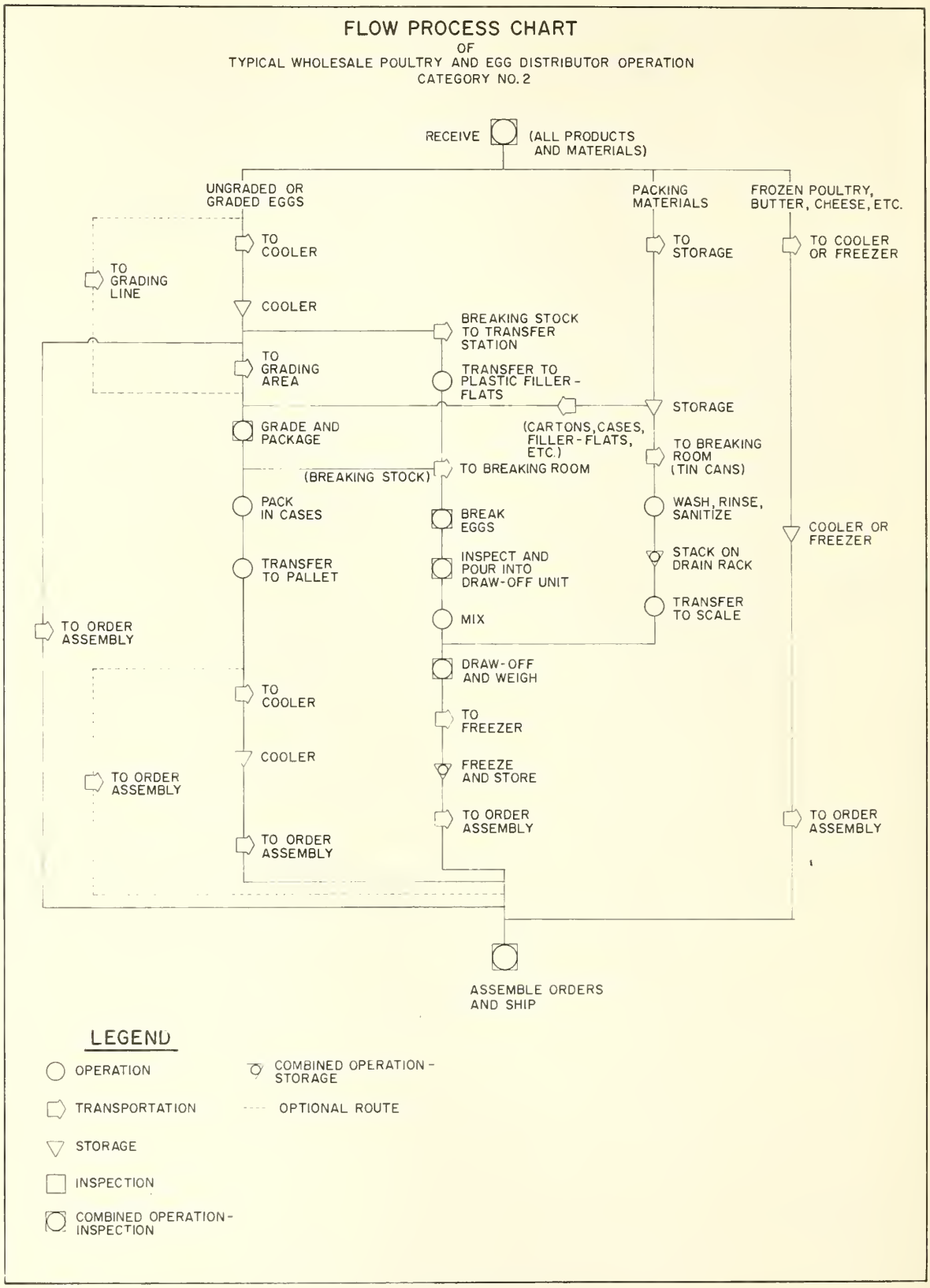
FLOW PROCESS CHART
OF
TYPICAL WHOLESALE POULTRY AND EGG DISTRIBUTOR OPERATION
CATEGORY NO. 2
RECEIVE
(ALL PRODUCTS AND MATERIALS)
UNGRADED OR GRADED EGGS
PACKING MATERIALS
FROZEN POULTRY, BUTTER, CHEESE, ETC.
TO COOLER
TO STORAGE
TO COOLER OR FREEZER
TO GRADING LINE
COOLER
BREAKING STOCK TO TRANSFER STATION
TO GRADING AREA
TRANSFER TO PLASTIC FILLER-FLATS
STORAGE
GRADE AND PACKAGE
(CARTONS, CASES, FILLER-FLATS, ETC.)
TO BREAKING ROOM (TIN CANS)
(BREAKING STOCK)
TO BREAKING ROOM
PACK IN CASES
BREAK EGGS
WASH, RINSE, SANITIZE
COOLER OR FREEZER
TRANSFER TO PALLET
INSPECT AND POUR INTO DRAW-OFF UNIT
STACK ON DRAIN RACK
TRANSFER TO SCALE
TO ORDER ASSEMBLY
MIX
DRAW-OFF AND WEIGH
TO COOLER
TO FREEZER
COOLER
FREEZE AND STORE
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
TO ORDER ASSEMBLY
ASSEMBLE ORDERS AND SHIP
LEGEND
OPERATION
COMBINED OPERATION - STORAGE
TRANSPORTATION
OPTIONAL ROUTE
STORAGE
INSPECTION
COMBINED OPERATION - INSPECTION

FIGURE 35.

TABLE 3.—*Cross-chart for a wholesale poultry distributor operation in a multiple-occupancy warehouse at specified weekly volumes* [1]

Movement from/to→ ↓	Receiving	Cooler	Poultry cut-up room	Freezer	Grading	Dry storage	Order assembly	Shipping	Total
	Number of unit loads moved per week [2]								
Receiving		93		18		[3] 14			125
Cooler			20		20		93		133
Poultry cut-up room		20							20
Freezer							18		18
Grading		20							20
Dry Storage [4]			1		3				4
Order assembly								111	111
Shipping									0
Total	0	133	21	18	23	14	111	111	

[1] Layout shown in fig. 23; volume guide, p. 19.
[2] Does not include movements directly from receiving to processing areas or processing areas directly to order assembly.
[3] Represents capacity of dry storage area or 1 month's supply of packing materials.
[4] Unit loads of packing materials are moved from dry storage to processing areas, but are not included in movement from these areas.

TABLE 4.—*Cross-chart for a wholesale egg distributor operation in a multiple-occupancy warehouse at specified weekly volumes* [1]

Movement from/to→ ↓	Receiving	Cooler	Breaking room	Freezer	Grading	Dry storage	Order assembly	Shipping	Total
	Number of unit loads moved per week [2]								
Receiving		63				14			77
Cooler			42		40		46		128
Breaking room				11					11
Freezer							11		11
Grading		40							40
Dry storage [3]			10		4				14
Order assembly								57	57
Shipping									0
Total	0	103	52	11	44	14	57	57	

[1] Layout shown in figure 23; volume guide, p. 19.
[2] Does not include movements directly from receiving to processing areas or processing areas directly to order assembly.
[3] Unit loads of packing materials are moved from the dry storage area to the egg breaking or egg grading areas and are utilized for packaging the product; therefore, they are not included in the number of movements from these areas.

TABLE 5.—*Package and materials handling data for commodities studied*

Item	Handling unit	Handling unit outside dimensions	Handling units per unit load [1]	Average net weight of item per handling unit	Average net weight of item per unit load	Average gross weight of unit load [2]
		Inches	*Number*	*Pounds*	*Pounds*	*Pounds*
Products:						
Butter	Fiber box	10 x 10 x 11	48	32	1, 536	1, 659
Cheese	Fiber box	11 x 15 x 8	45	40	1, 800	1, 965
Eggs, shell	Fiber case 30 doz.	12 x 24 x 13	30	45	1, 350	1, 515
Eggs, shell (breaking stock)	Plastic filler-flat.	11½ x 11½	144	3	432	507
Eggs, frozen	Tin can	10 x 12½	60	30	1, 800	1, 995
Poultry, icepacked	Wirebound box.	18 x 24 x 9	24	65	1, 560	2, 475
Poultry, frozen [3]	Fiber case	17½ x 24 x 10	24	50	1, 200	1, 347
Packing materials:						
Boxes, wirebound	Bundle of 10	24 x 52 x 10	12	60	720	795
Cans, tin, 30-pound	Can	10 x 12½	60	2	120	195
Cartons, chipboard	Bundle of 250	12 x 23¼ x 10¼	36	35	1, 260	1, 335
Cartons, molded-pulp	Bundle of 250	19 x 27¾ x 11½	20	24	480	555
Cases, fiber, 30 doz.	Bundle of 25	24 x 24 x 10	12	80	960	1, 035
Filler flats	Bundle of 140	11½ x 34 x 11½	20	18½	370	445

[1] The unit load for all items is based on the use of 36- by 48-inch pallets.
[2] Includes weight of product, packing materials, and pallet (75-pound average pallet weight).
[3] Data are for frozen turkeys.

TABLE 6.—*Inventory evaluation guide by commodity at specified operating volumes for a wholesale poultry and egg distributor operation in a multiple-occupancy warehouse*

Commodity	Unit	Assumed inventory turnovers per week	Category 1 (poultry operation)			Category 2 (egg operation)		
			Average inventory refrigerated storage		Average weekly volume	Average inventory refrigerated storage		Average weekly volume
		Number	*Units*	*Unit loads*	*Units*	*Units*	*Unit loads*	*Units*
Butter	Pound	1	6, 144	4	6, 144	6, 144	4	6, 144
Cheese	Pound	1	3, 600	2	3, 600	3, 600	2	3, 600
Eggs, shell	30-doz. case	2	300	10	600	900	30	1, 800
Poultry, frozen	Pound	2	10, 800	9	21, 600	----------	----------	----------
Poultry, icepacked	Pound	3⅓	31, 200	20	104, 000	----------	----------	----------

TABLE 7.—*Heating, refrigeration, and air-conditioning loads for a wholesale poultry and egg operation in a multiple-occupancy warehouse*

Item and unit	Operation	
	Poultry	Egg
Heating load (B.t.u./hr.) [1]	110, 000	110, 000
Refrigeration (tons): [2]		
Cooler	4	5
Freezer	[3] 1	4
Total refrigeration (tons)	5	9
Air-conditioning (tons) [2]	8	8

[1] Figures are rounded to nearest 10,000 B.t.u./hr.
[2] Figures are rounded to nearest whole number.
[3] If production from the cut-up poultry operation is to be frozen, add 4 tons to freezer refrigeration.

TABLE 8.—*Recommended materials-handling equipment for a wholesale poultry and egg distributor operation in a multiple-occupancy warehouse*

Equipment item description	Number of items per category		Purpose
	Poultry	Eggs	
Bridgeplate	2	2	To permit materials-handling equipment to move on and off trucks.
Conveyor, reversible belt (34′ long, 24″ wide, 30° slope).	1	1	Movement of shell eggs and packing materials between floors.
Conveyor, gravity-roller:			
24-inch:			
5-ft. section	[1] 3	3	Movement of shell eggs and packing materials between floors, temporary storage of ungraded eggs adjacent to the grading line, holding and freezing production from processing room and in conjunction with reversible-belt conveyor permitting direct movement of shell eggs between truck and grading room on second floor.
10-ft. section (portable)	[1] 7	7	
12-inch: 10-ft. section	3	3	Movement of empty egg cases from the grading line to the packing station.
Handtruck (2-wheel)	2	2	Handling of small quantities of product and material or during periods of high activity when pallet transporters are in use.
Pallet (2-way entry, 36″ x 48″)	[2] 70	[2] 70	Storage and intraplant transport of product and material.
Pallet transporter (manual):			
2,000-lb. capacity	1	2	For pallet load handling of product and material where high stacking is not required.
2,500-lb. capacity	1		
Pallet transporter, straddle-type electric high-lift:			
2,000-lb. capacity		1	For high-stacking in refrigerated storage and transporting pallet loads of product and material on 1st floor.
2,500-lb. capacity	1		

[1] Based on the assumption that production from the cut-up poultry operation is frozen.
[2] 10 percent over minimum requirement is recommended for part-pallet loads and pallets out of service for repair.

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The marketing research in this report is part of a broad continuing program of USDA's Agricultural Marketing Service to bring marketing services to consumers, industry, and farmers. The seal shown below is the symbol of the 50th year of organized marketing service. In 1913 the first marketing agency, the Office of Markets, was established in USDA. It was a predecessor of the Agricultural Marketing Service.

This report is one of a group that has helped improve the marketing of poultry, eggs, and egg products. It summarizes research that will reduce the cost of preparing these products for market while maintaining the natural qualities of the products.

Research is conducted at field stations in the large poultry and egg producing areas, where improvements can be tested under commercial conditions. Improved layouts for large egg grading and packing plants and wholesale warehouses have been designed and similar studies are being made on poultry processing plants. Mechanized egg grading and packing equipment developed by AMS is estimated to save the industry a million and a half dollars a year.

Marketing will continue to change, and marketing research will continue to find more and more ways of safeguarding and improving foods and fibers. Mass production cannot exist without mass marketing—and both are constantly evolving new forms.